The Welding Engineer

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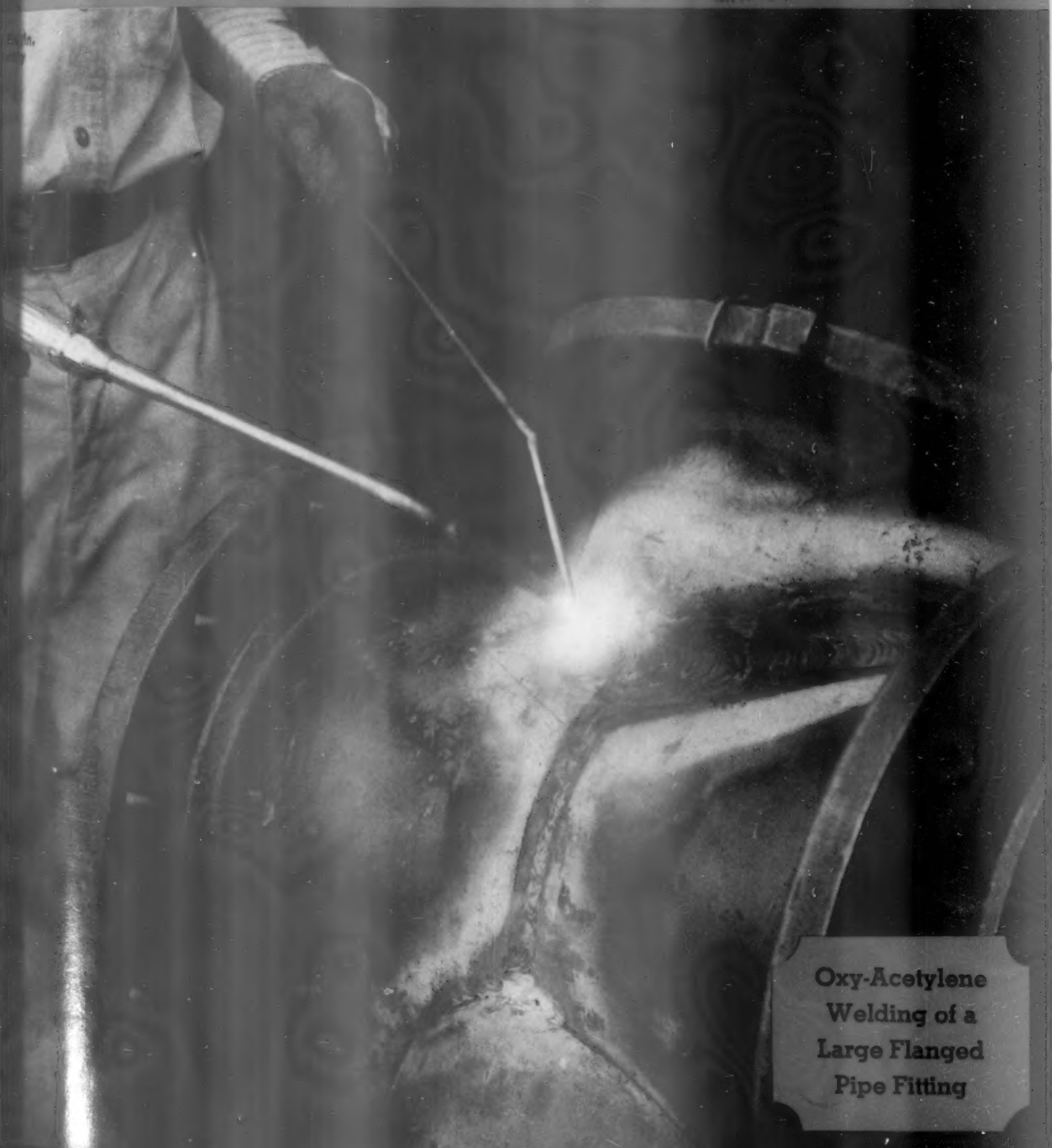
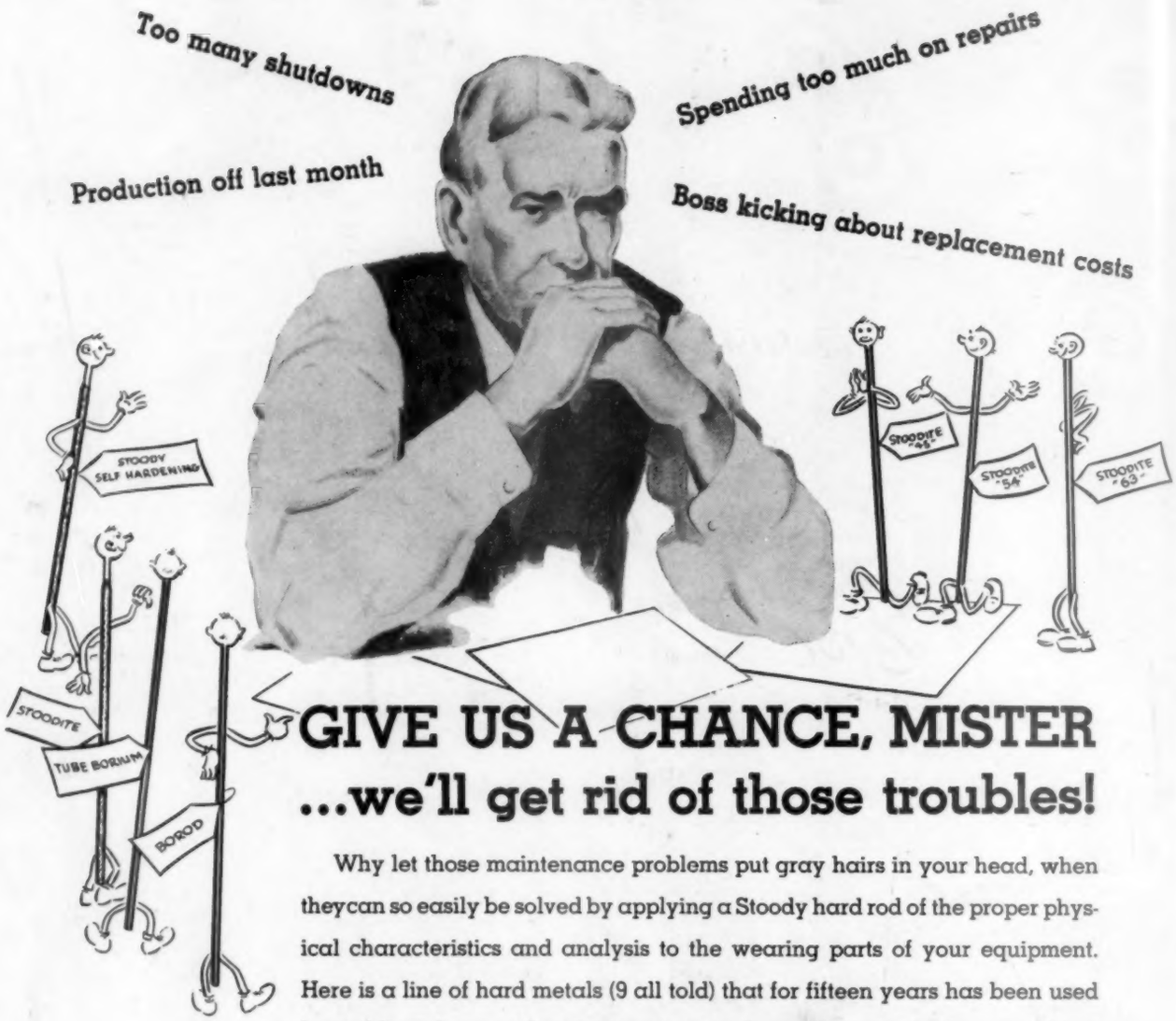


Oxy-Acetylene Welding of a Large Flanged Pipe Fitting



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NO. 5

The Welding Engineer

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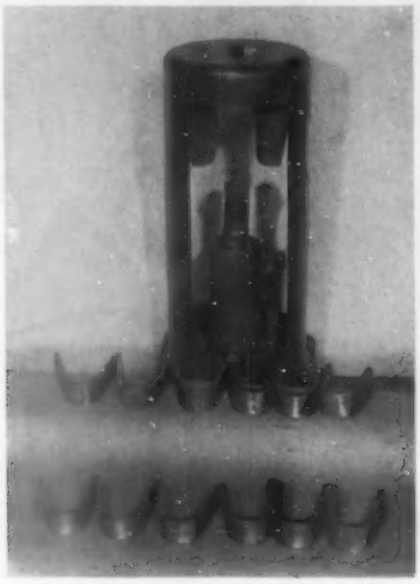


A simple restricted-bend test jig for ⅜ in. thick specimens. Top row shows root bends, bottom row shows face bends.

Applications of
oxy-acetylene processes in

Welded High-Pressure Piping

★ Superiority of "back-hand" welding on pipe joints is well demonstrated in restricted bend tests of specimens—Multi-layer gas welding technique produces economies, using one layer for each ¼ in. wall thickness

By A. N. KUGLER*
Applied Engineering Department, Air Reduction Sales Co., New York City

THE TERM high pressure as applied to piping is subject to many interpretations. To one installing a heating system where 5 to 10 psi. is a common pressure range, 100 psi. is high pressure. On the other hand this pressure would be considered low by a steam power plant or refinery operator with whom 900 to 1100 psi. and up to 1000 deg. F. are not uncommon. What then is the criterion for determining high pressure? At various times definite pressures have been arbitrarily chosen as the point of division. Such points have been 100 psi., 250 psi., while today 450 psi. is generally accepted. However, this question can be approached from another angle namely pipe wall thickness which factor more directly influences the welding technique. Pipe wall thickness is governed by operating conditions, that is pressure and temperature. Another factor that sometimes affects the thickness is the presence of corrosive conditions. Standard specifications governing selection of proper thicknesses will be found in the A.S.A. Code for Pressure Piping and A.S.T.M. specification A106-36. For the purposes of this discussion, pipe ½ in. thick and greater will be considered high-pressure piping.

Since pipe wall thickness is the one element, other than steel analysis, which has a marked influence on welding technique, its relation to the procedure should be studied carefully. However, before making this study we should know something of the methods of testing pipe welds to evaluate the relative physical properties of welds produced by the various methods.

In the current edition of the A.S.A. Code (American Tentative Standard 1935) the welding operators qualification tests provide for testing welds by the familiar reduced-section tensile test, the free-bend test, the reverse or back-bend test and the nick-break test. These same tests form an excellent basis for comparing various welding methods. There is, in addition, a relatively new test which no doubt will supplant those enumerated above. This new test known as the restricted or guided bend test has been used for several years by the U. S. Navy Department with excellent results. The bends are made in a jig proportioned in terms of the specimen thickness. The jig con-

*From author's paper presented at recent annual meeting of International Acetylene Association, Houston, Tex.

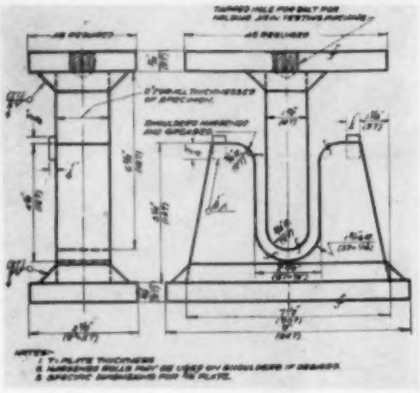
sists of a die and plunger which forces the specimens into a "U" shape. When the face or top of the weld is in tension it is known as a "face bend," while with the root in tension it is a "root bend."*

The minimum physical properties to be developed on these tests are those given for the operators' qualification. Obviously these minimums should be greatly exceeded in laboratory work to provide for the inevitable variations between laboratory and field conditions. For the reduced-section tensile test the minimum requirement is 90% of the minimum specified for pipe material. The free-bend test must show an elongation of not less than 15%, while the reverse-bend test must bend 90 deg. without breaking apart. On the nick-break test, the fracture must not have more than 6 defects per sq. in. and no defect may be greater than 1/16 in. Requirements for the restricted bend test are simple and therein lies one of the principal advantages of this test. It is merely that the specimens, both face and root, bend to the full capacity of the jig.

With this background of test methods it is possible to consider the methods of fulfilling these requirements by oxy-acetylene welding. Of all the methods of pipe welding, the oldest is perhaps the so-called fore-hand or puddle welding method. In this the torch and rod are so disposed that the torch flame points ahead of the completed weld and the rod precedes the torch. To produce sound welds it is necessary to give the rod and torch opposite oscillating motions. While it is possible to produce welds meeting the test requirements, it requires a high degree of skill. The extensive manipulation of rod and molten metal particularly on heavy wall pipe tends to create porosity with consequent lowering of ductility.

The back-hand technique also known as carburizing flame welding was developed about 10 or 12 years ago. In it, the torch and rod are so disposed that the torch flame points back at the completed weld and the rod is interposed between the torch and weld. In this procedure, torch and rod manipulation are greatly simplified and the width of vee is reduced to 70-deg. Welds of this type readily develop 100% of the strength of the pipe on reduced-section tensile tests. Free-bend tests develop 20 to 45% and as high as 55% elongation. Reverse-bend tests bend 180 deg. without any sign of failure. Nick-break tests showing far less than 6 defects (all within allowable limits) per sq. in. are standard results, while most of the specimens show no defects. The superiority of back-hand welding is clearly demonstrated in the restricted bend tests, where specimens consistently bend to the full capacity of the jig. In all of these tests, except the tensile test, fore-hand welds will show lower values. The tensile strength will be about the same or slightly higher due principally to a lack of ductility.

*Drawing shown on page 19 of February, 1939 issue of *The Welding Engineer*.



A.W.S. restricted bend test jig. Dimensions shown are for specimens of ⅜ in. wall thickness. For heavier specimens, the dimensions would be proportionately larger.

Multi-Layer Welding

Back-hand welding of the thinner wall thicknesses up to about ⅜ in. is a standard operation with many welders. In this the weld is made in a single layer, or pass, and physical properties as noted are regularly obtained. The welding of pipe greater than ⅜ in. thick in one layer, whether by fore-hand or back-hand welding presents some difficult problems. The principal one is the large puddle of molten metal which must be maintained. On ¾ in. thick pipe this puddle may be as large as 1½ to 2 in. in diameter. This large pool of molten metal is created when the operator attempts to fuse the bottom edges of the vee and still maintain proper fusion at the upper corners. True, back-hand welding reduces many of these troubles to a minimum, nevertheless they are present, tending to reduce welding speed and weld quality. To overcome this, multi-layer welding was developed.

Multi-layer welding, as the name indicates, comprehends the deposition of weld metal in layers. However, it should not be confused with the somewhat similar arc welding technique. The layers of the former usually bridge from one side of the vee to the other. In the latter process, except for the first few beads, the deposited metal does not usually span the vee. Further the thickness of the individual layers of multi-layer welds will be greater than on arc welds. In general one layer for each ¼ in. of thickness should be deposited. Thus for ½ in. thick pipe use two layers; for ¾ in. wall thickness, three layers and for 1 in. four layers.

Field experience with multi-layer oxy-acetylene welding indicates saving in time and materials. The economies in welding time are the result of welding on relatively thin layers, permitting the operator to devote his attention to the particular difficulties of that zone. The reduction in welding gases and rods is obtained through the reduced size of puddle carried and the lessened depth of fusion. Overall cost reductions of 15 to 25% are reported.

Weld Quality

Of greater importance is the improvement in weld quality so essential on high-pressure piping. The simplification of welding procedure enables average welding operators to make welds which fulfill the test requirements. Tensile strengths equal to that of pipe material are regularly obtained. Free-bend ductilities of 25 to 50% and occasionally higher are on record. Back-hand tests invariably go 180 deg. without sign of failure. Flawless nick-break specimens are the rule. The results on the severe guided bend test are equally gratifying—specimens bend the full capacity of the jig. Thus we see that for the welding of high-pressure piping (heavy wall pipe) multi-layer oxy-acetylene welding should be used.

Naturally in a laboratory investigation of a welding procedure many other tests are employed to check results and develop as many physical properties as possible. Among these is the all-weld-metal tensile test. Specimens for this test are machined longitudinally from the weld metal. They are of circular cross section 0.505 in. diameter for the central 2 in. of length and provided at each end with ¾ in. threads for gripping. The minimum requirements for this test vary with the type of filler material used, A.S.T.M. specification A205-37T classifies filler metal by grade, listing the tensile strength and elongation in 2 in. required for each. For high-pressure carbon steel pipe

welding in Grades A and B it is recommended that Grade 10 welding rods be specified. Grade 10 rods, in the non-stress relieved condition, must develop 60,000 psi. and 20% elongation in 2 in. Since the welding of these tests is performed on ¾ in. plate, obviously multi-layer welding must be used to meet requirements.

Thus far only carbon steel pipe has been considered for the reason that it is more generally encountered. With the recent trend towards higher pressures and temperatures it has become necessary to use steels capable of withstanding these severe conditions. A.S.T.M. specification A158-36 lists many of the analyses suitable for temperatures of 1100 deg. F. The particular value of these steels is that they possess high creep strengths at elevated temperatures, permitting use of thinner wall pipe than would be possible with plain carbon steel pipe. Thus we have carbon-molybdenum, chrome-molybdenum, nickel-molybdenum, 18% chromium 8% nickel, and other analyses each suited to some pecular pressure, temperature or corrosive condition. In general a welding rod of the same analysis should be used for welding these steels.

Carbon-molybdenum steel is probably the best known of these analyses since it has been used extensively on the modern high-pressure, high-temperature steam-electric generating plants. Steam at 900-1400 psi. and 900 to 1100 deg. F. is being successfully carried in the so-called "carbon-moly" pipe. The analysis of this steel according to A.S.T.M. A158-36 is as follows:

Carbon	0.10 - 0.20%
Manganese	0.30 - 0.60%
Phosphorus	0.04% max.
Sulfur	0.05% max.
Silicon	0.02 - 0.50%
Molybdenum	0.45 - 0.65%

Most of this pipe installed to date has been arc welded using a specially designed joint. In this joint the ends are upset, bevelled or grooved and bored internally to receive a liner. On some installations oxy-aceylene welding has been employed with the same type of joint, using a thicker upset section to offset the difference in strength. Several piping fabricators have felt that oxy-acetylene welding would expedite the operation and yield lower costs. In response to this demand an oxy-acetylene welding rod of carbon-molybdenum analysis has been developed. It is now undergoing field tests and results are most promising. Since all of this pipe is of heavy wall thickness, obviously multi-layer welding is employed along with the back-hand technique to insure highest possible quality.

In arc welding after the prepared pipe ends have been tacked, electric preheating coils are placed around them and the temperature raised to 300-550 deg. F. When the desired temperature is reached welding starts. The preheat temperature is maintained during welding, by thermocouple controls. Welding progresses with small beads deposited with ⅛ and 5/32 in. electrodes. It is common practice to chip out part of each bead to insure absence of foreign inclusions. After a weld is completed it is stress relieved by heating with electric coils to a temperature of 1100-1200 deg. F. The rate of temperature rise is maintained at 250 deg. F. per hour. The joint is held at the stress-relieving temperature for four hours per inch of thickness, after which it is cooled at the same definite rate.

Stress-relieving a pipe weld with the multi-flame oxy-acetylene torch.

After heating to 1450 deg. F., the welded joint is wrapped with asbestos blocks and allowed to cool slowly.

Stress-relieved joints on an expansion loop.

Oxy-acetylene welding of these same joints, including the liner, would progress without preheating, other than that obtained in the normal operation of the torch. If desired, preheating can be employed using either the electric method or an auxiliary torch. Its use will tend to speed up welding and reduce gas consumption slightly. However, separate preheating is not essential for producing high quality welds. The actual welding proceeds as outlined for multi-layer welding with the exception that a greater number of layers is employed. For example, five layers are used on ⅞ in. thickness. The final layer should always be deposited above the level of the pipe wall surface to insure the maximum heat treating benefits on the previously deposited layers. The stress relieving of carbon-molybdenum steel is dictated by the steel properties rather than by the welding technique. Hence the same general procedure will be employed for both methods. Stress relieving with the oxy-acetylene torch is used by some contractors and offers advantages in economy and speed.

The laboratory test results of these oxy-acetylene carbon-molybdenum welds indicates that the physical properties of the base metal are readily duplicated. Reduced-section tensile test failures occur in the pipe metal. Free-bend test ductilities of 30-40% and over are readily obtained. The reverse-bend and nick-break tests, which are more tests of the operator's ability than quantitative tests of weld metal, consistently exceed minimum requirements The all-weld-metal tensile test specimen develops 65,000 to 80,000 psi.

and 25 to 30% elongation in 2 in. Restricted-bend test specimens bend to the full capacity of the jig without any sign of failure. It must be remembered that these results were obtained in the laboratory, where conditions are under close control and not subject to the uncontrollable variables encountered in the field.

Local Stress Relieving

An important phase of the procedure for welding of all-high-pressure piping is stress relieving. The primary purpose of this operation is to relieve the welded assembly of locked up stresses, but in addition it provides a measure of grain refinement all of which is reflected in an increase in weld ductility. The A.S.A. Code requires that welded joints in carbon steel piping shall be stress relieved, when the pipe wall thickness is ¾ in. or greater and the service temperature is in excess of 250 deg. F. The actual heating is carried out in several different ways depending on conditions. In the fabricating shop, furnaces provide the most convenient and economical method of handling the large assemblies. In the field, electric coil units have found wide acceptance.

Another field method is to employ small portable furnaces, one for each size of pipe, fired with city or natural gas and air. Those have proven satisfactory on a number of large jobs. Still another field method employs oxy-acetylene torches equipped with multi-flame tips. This equipment is used under the standard stress-relieving procedure, because of its portability and quickly available high heat. However, on a recent large installation on which stress-relieving was specified on extra-heavy pipe another oxy-acetylene procedure was employed.

In this method the weld and adjacent pipe is heated uniformly to 1450 deg. F. which temperature is checked by pyrometer. When the joint has reached the desired temperature, heating is stopped and it is wrapped with asbestos blocks or paper, the ends plugged, if open, and allowed to cool slowly. Sample welds subjected to this heat treatment were tested by the consulting engineer on the job. Results of these tests showed excellent grain refinement throughout the weld area. In addition weld ductility was materially increased without serious loss in tensile strength. Approval to use this oxy-acetylene method was granted on the basis of these tests, in spite of the fact that another method of stress relief had been specified.

In actual construction work this procedure has proven successful and economical. Multi-flame tips and two or more torches are used on large diameter pipes. Recent tests were made of field welds by trepanning circular plugs from the welds and all showed up excellently when etched.

To sum up, the procedure for oxy-acetylene welding of high-pressure piping requires the selection of a suitable welding technique—multi-layer welding, second, the use of a suitable welding rod—Grade 10 for carbon steel pipe and rods of the same analysis as the base metal for alloy steel pipe—and finally the determination of a proper stress-relieving or heat treatment to insure a minimum of locked up stresses.

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New Proposed Standard For Welding Fittings

By E. HALL TAYLOR*

★ New developments in welding fittings have come about so gradually that most users are not aware of the type changes and of the improvements in fittings that are now available. Of first importance from the user's standpoint is the new "Proposed Standard for Welding Fittings." This new standard covers the overall dimensions of the fittings in elbow, tees, caps, reducers, return bends, and lap joint stub ends. It also covers the pressure ratings, size, marking, material, metal thickness, tolerance and the welding bevel.

Engineering departments can now, with these standards established, lay out pipelines with the knowledge that the fittings will conform to the new proposed dimensions. Copies of this new proposed standard can be obtained from The American Society of Mechanical Engineers, 29 West 39th St., New York City.

The angle of the bevel for butt welding has finally been agreed upon in this new standard. The bevel formerly used was 45 deg. and the new bevel is 37½ deg. This bevel has been in use in pipeline work for some time. As fast as changes can be made, the 37½ deg. bevel will be adopted on welded fittings. The narrow groove formed by this bevel has the advantages of requiring less weld metal, thus saving time and material.

Welding small diameter pipe has always presented a problem in lining up and in welding. The wall thickness of pipe 2 in. and under is of course comparatively thin. When this is bevelled for welding, the narrow bevel is not easy to line up with the pipe, and welding the thin wall requires care to avoid burning through. The development of socket welding fittings several years ago solved these difficulties, but, it has only been recently that they have come into widespread use.

It is easy to center pipe in a socket fitting as the pipe slips into the end of the fitting for a short distance. A fillet weld is made between the fitting and the pipe. There is no danger of burning through, as this weld is on the outside of the pipe. The strength of these fittings is such, that in many tests to destruction, the pipe has always failed before the fitting shows distress. Socket fittings are now produced by several manufacturers and their use

Table 1 Dimensions of Butt-Welding Elbows and Tees

Size	Outside Diameter	Center-to-End		
		90-Deg Welding Elbows A	45-Deg Welding Elbows B	Of Run Welding Tee C
⅛	0.840	¾	½	⅜
¼	1.050	1	⅝	1 ⅛
¾	1.315	1 ⅛	⅞	1 ⅛
1	1.315	1 ½		1 ½
1 ¼	1.660	1 ⅞	1	1 ⅞
1 ½	1.900	2 ¼	1 ⅛	2 ¼
2	2.375	3	1 ⅜	2 ½
2 ½	2.875	3 ¾	1 ¾	3
3	3.500	4 ½	2	3 ⅜
3 ½	4.000	5 ¼	2 ¼	3 ⅞
4	4.500	6	2 ½	4 ⅛
5	5.563	7 ½	3 ⅛	4 ⅞
6	6.625	9	3 ¾	5 ⅛
8	8.625	12	5	7
10	10.750	15	6 ¼	8 ½
12	12.750	18	7 ½	10

Proposed dimensions for butt-welding elbows and tees.

*From author's paper at recent annual meeting of I.A.A. at Houston, Tex. Mr. Taylor is vice-president of Taylor Forge and Pipe Works, Chicago, Ill.

Table 2 **Dimensions of Butt-Welding Caps and Lapped-Joint Stub Ends**

Size	Outside Diameter	Welding Caps	Lapped-Joint Stub Ends		
			Length	Radius of Fillet	Diameter of Lap
		E[1]	F[1]	R	G
¾	1.050	1 ½	...	...	...
1	1.315	1 ½	4	1/8	2
1 ¼	1.660	1 ½	4	5/16	2 ½
1 ½	1.900	1 ½	4	¼	2 ⅞
2	2.375	1 ½	6	5/16	3 ⅝
2 ½	2.875	1 ½	6	5/16	4 ⅛
3	3.500	2	6	⅜	5
3 ½	4.000	2 ½	6	⅜	5 ½
4	4.500	2 ½	6	7/16	6 5/16
5	5.563	3	8	7/16	7 5/16
6	6.625	3 ½	8	½	8 ½
8	8.625	4	8	½	10 ⅝
10	10.750	5	10	½	12 ¾
12	12.750	6	10	½	15
14	14.000	6 ½	12	½	16 ¼
16	16.000	7	12	½	18 ½
18	18.000	8	12	½	21
20	20.000	9	12	½	23
24	24.000	10 ½	12	½	27 ¼

Proposed dimensions for butt-welding caps and lapped-joint stub ends.

should do much to increase the welding of pipe 2 in. and smaller.

New developments in welding methods have steadily improved weld quality and increased the speed of welding. This has done much to further the installation of welded piping systems. We can now safely say that the quality of welding today is such, that in every case, the welded joint is equal to or stronger than the pipe itself. We feel, that the same statement should hold true of welding fittings in order to give a full strength pipeline throughout. In order to accomplish this, fittings should be reinforced at the points of greatest strain. Tests to destruction have been conducted on many fittings in which the seamless pipe has burst before the fitting, showing how well this reinforcing has strengthened the fitting against deformation.

How Much Reinforcement?

The reinforcing of branch connections attached to pipe by welding has assumed such importance that a committe has been formed by the American Standards Association to study this for addition to the Code for Pressure Piping. Extensive tests are being run by the members of this committee to determine just what the strains are and what reinforcement is necessary, when a hole is cut in a pipe for a branch connection. It is not generally recognized how much a pipe is weakened when a hole is cut in it for a branch outlet. Our tees are designed with reinforcement around the branch so that the strength of the tee is approximately equal to the yield point of the pipe, thus eliminating any weakness at the outlet connections.

Another development in the use of welded fittings and one that is growing all the time, is the forming of expansion loops by their use. Expansion loops made of welding fittings are flexible and can easily be made to fit almost every expansion condition and requirement. Cutting pipe to length and attaching by means of welding fittings is all that is required to make a loop. As expansion is taken care of by varying the pipe length, the elbow serves as a flexible pivot point and the expansion is absorbed by the flexing of the pipe. This is a simple, inexpensive and safe way to take care of expansion in a pipeline.

In the past few years, the design of the hub on butt weld flanges has been so improved that there is no danger of the heat of welding warping the face of the flange. Warping has been encountered in some cases where slip-on flanges were used as the weld is so near the face of the flange that the heat has some effect upon it. In some cases it has been neecssary to machine the face of the slip-on flange after welding. The use of butt-weld flanges eliminates any danger of warping and the need for remachining.

We are all aware that welding is used today on practically every installation that requires high quality. However, there are many low-pressure installations where the user feels that welding is too costly. It has been our aim in making new developments in welding fittings, to produce a fitting that will lower the cost of a welded installation. Now, the cost of welding a fitting into line is not just the cost of making the

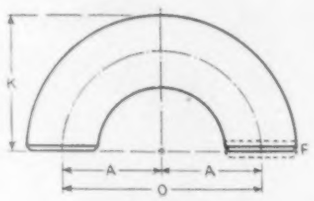

Table 4 **Dimensions of Butt-Welding 180-Deg Return Bends**

Size	Outside Diameter	Center-to-Center O	Back to Face K
¾	1.050	2 ¼	1 11/16
1	1.315	3	2 3/16
1 ¼	1.660	3 ¾	2 ¾
1 ½	1.900	4 ½	3 ¼
2	2.375	6	4 3/16
2 ½	2.875	7 ½	5 3/16
3	3.500	9	6 ¼
3 ½	4.000	10 ½	7 ¼
4	4.500	12	8 ¼
5	5.563	15	10 5/16
6	6.625	18	12 5/16
8	8.625	24	16 5/16
10	10.750	30	20 ⅜
12	12.750	36	24 ⅜

Proposed dimensions for butt-welding 180-deg. return bends.

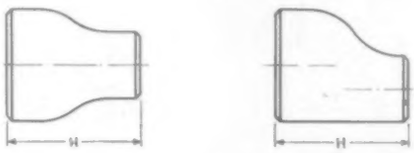

Table 3 **Dimensions of Butt-Welding Reducers**

Size	Outside Diameter		End-to-End H
	Large End	Small End	
1 × ¾	1.315	1.050	2
1 × ½	1.315	0.840	2
1 × ⅜	1.315	0.675	2
1 ¼ × 1	1.660	1.315	2
1 ¼ × ¾	1.660	1.050	2
1 ¼ × ½	1.660	0.840	2
1 ½ × 1 ¼	1.900	1.660	2 ½
1 ½ × 1	1.900	1.315	2 ½
1 ½ × ¾	1.900	1.050	2 ½
1 ½ × ½	1.900	0.840	2 ½
2 × 1 ½	2.375	1.900	3
2 × 1 ¼	2.375	1.660	3
2 × 1	2.375	1.315	3
2 × ¾	2.375	1.050	3
2 ½ × 2	2.875	2.375	3 ½
2 ½ × 1 ½	2.875	1.900	3 ½
2 ½ × 1 ¼	2.875	1.660	3 ½
2 ½ × 1	2.875	1.315	3 ½
3 × 2 ½	3.500	2.875	3 ½
3 × 2	3.500	2.375	3 ½
3 × 1 ½	3.500	1.900	3 ½
3 × 1 ¼	3.500	1.660	3 ½
3 ½ × 3	4.000	3.500	4
3 ½ × 2 ½	4.000	2.875	4
3 ½ × 2	4.000	2.375	4
3 ½ × 1 ½	4.000	1.900	4
3 ½ × 1 ¼	4.000	1.660	4
4 × 3 ½	4.500	4.000	4
4 × 3	4.500	3.500	4
4 × 2 ½	4.500	2.875	4
4 × 2	4.500	2.375	4
4 × 1 ½	4.500	1.900	4
5 × 4	5.563	4.500	5
5 × 3 ½	5.563	4.000	5
5 × 3	5.563	3.500	5
5 × 2 ½	5.563	2.875	5
5 × 2	5.563	2.375	5
6 × 5	6.625	5.563	5 ½
6 × 4	6.625	4.500	5 ½
6 × 3 ½	6.625	4.000	5 ½
6 × 3	6.625	3.500	5 ½
6 × 2 ½	6.625	2.875	5 ½
8 × 6	8.625	6.625	6
8 × 5	8.625	5.563	6
8 × 4	8.625	4.500	6
8 × 3 ½	8.625	4.000	6
10 × 8	10.750	8.625	7
10 × 6	10.750	6.625	7
10 × 5	10.750	5.563	7
10 × 4	10.750	4.500	7
12 × 10	12.750	10.750	8
12 × 8	12.750	8.625	8
12 × 6	12.750	6.625	8
12 × 5	12.750	5.563	8

Proposed dimensions for butt-welding reducers.

weld—that is often the smallest part of the cost of making a joint. Often the largest part of this cost is that of making ready, laying out, cutting and fitting and lining up to get ready to weld. These are the costs we tried to reduce by new developments in fittings.

The first step, is to insure the welding operator getting the right fitting for the job. This may seem a small item, but shop men know how much time can be wasted looking up tickets and tags and checking dimension tables, trying to identify fittings from a stock pile full of various sizes and standards. To provide positive identifications, the size and standard of each fitting is stamped into the fitting along its side. Anyone without any knowledge of pipe standards can easily identify a fitting so stamped.

Given the right fitting, we next tackle the problem of lining it up. Fittings are machine bevelled accurately so there is no problem in their joining evenly against the pipe end. The real time lost is in trying to determine the angle at which the fitting should be turned so as to fit the next run of piping. An angle cannot be measured without some reference point to start from, so the center line of the fitting must first be determined. This takes time and is not the easiest thing to do on an irregularly shaped object like an elbow. Hence, the new development of marking center pines on elbows. These center lines are machine marked for accuracy. With these as reference points it is easy to determine any angle at which it is wished to place the elbow.

Lining up the welding fitting so that it is concentric with the pipe end, is a problem that many have worked on. Various jigs and clamps have been made to do this; some of them are very helpful and time can often be saved by using them. In all cases, easy means of lining up are not available. A new fitting which lines itself up, has now been developed with a centering ring as part of the fitting. This centering ring, forged integral with the fitting, centers the elbow into the pipe, thus assuring accurate alignment instantly without an leveling or shimming. This ring will support the pipe end, holding it in readiness for welding, thus eliminating the need for extra supports.

In addition to saving time in lining up, this ring has been found to improve the strength of the joint weld by assuring complete penetration. This centering lip acts as a backing up ring for the weld metal without fear of burning through; thus the weld extends clear down to the bottom of the bevel, which is not always the case in some butt welds. The ring stops weld metal from flowing inside the pipe, thus preventing forming any projections or icicles to obstruct the flow. The ring is an integral part of the elbow, so there is no danger of its coming loose in the line. It is so small and fits so snugly to the pipe, that there is no measurable friction loss.

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Dravo Corp. Builds Two All-Welded Tow Boats

Fig. 1—One of two welded tow-boats built for river service.

By J. F. SMITH*

★ Two all-welded single screw river towboats, designed and built by the Dravo Corp. of Pittsburgh, Pa., have proved their efficiency in actual towing service. The Dravo 41 and Dravo 42 are sister ships. They are 94 ft. long, have a 21-ft. beam, and a hull, 6 ft. 9 in. deep. They have a displacement of 160 tons in full operating condition with a draft of 4 ft. 10 in. Each boat carries a 350-hp. diesel engine. Figure 1 shows Dravo 41 in operating condition.

Seventy tons of steel were used in construction of each hull and 18½ tons were used for each superstructure, making a total of 88½ tons of steel. Each boat has four cabins on the main deck adjacent to the engine room. At the forward end of the main deck are the galley and mess room. On the upper deck, just aft of the pilot house, are quarters for the master and pilot. The hulls of the ships are of the completely molded type. The shell plating at the stern of the hull is recessed to make a tunnel for the propeller, which is a typical construction for shallow-draft propeller boats.

Some of the factors which lend themselves to welded construction, in boats of this type, are their lighter weight and lower maintenance costs. A 15% weight saving was realized in these boats, which in turn gives more pay-load capacity. Maintenance savings are gained by having constantly tight seams. Boats of riveted construction are continually springing leaks along the seams, either from loose rivets, or from the caulked edges pulling away from the plating as a result of grounding or collision in the vicinity of the seams. Figure 2 and Fig. 3 illustrate effects of damage in vicinity of riveted and welded seams.

The building of the hulls was unique in that they were built in three complete parts in the welding shop and transported to the building ways for complete assembly. Each part—the forward, middle, and aft part—was built upside down in order to facilitate fitting and to permit as much flat weld-

*Welding Engineer, Dravo Corp., Pittsburgh, Pa.

Fig. 2a—Riveted joint with seam distorted by abnormal stretch in plates. Water can leak by caulking edge.

Fig. 2b—Welded joint is always water tight even when plates are abnormally stretched.

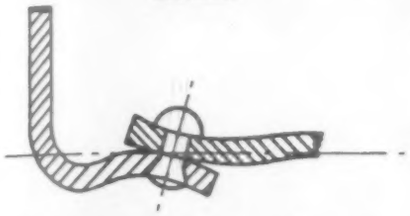


Fig. 3a—Water can leak by caulking edge when ship is damaged in area of rivets.

Fig. 3b—Welded seam still intact after damage in area of welding.

ing as possible. The framing for the forward part, erected on the deck plating, is shown in Fig. 4. Prior to shop assembly of the units, all transverse frames were built to templates and jigs.

The plating, which was straked longitudinally, was laid over the framing and pulled into shape by use of special

Fig. 5—Forward and mid-section set on building ways prior to making final welded connection.

fitting clamps. After the shop units were completely welded and transported to the ways, the center section was set up and levelled. The forward and aft sections were drawn into place, levelled and then welded to the center section. Figure 5 shows the forward section set directly in front of the center section, prior to making the final connection.

This method of building the hulls in separate units makes for more accurate workmanship. When a boat is built and welded in this way, it is closer to drawing dimensions, than one which is assembled and welded as a complete unit. A hull built in a single unit contains the shrinkage of the total of all the welding. Vessels of the size of Dravo 41 and Dravo 42, when built as a single unit, can shrink as much as one inch in overall length. When building the hulls in multiple units, each unit has an accumulated shrinkage relative to the amount of welding thereon, but adjustments can be made when they are joined together, thus keeping the over-all sizes exactly to drawing dimensions.

All welding, including that of the superstructure, was done by starting at the center of each unit and proceeding out to the sides and towards the ends. This was to reduce locked-up stresses to a minimum. Lap-welded seams were used almost exclusively throughout the hull and superstructure. Tests conducted in the past show that this type of joint has less residual stress than butt-welded joints. All outside seams were continually welded and all inside seams were intermittently welded, with exception of watertight bulkheads, which were welded continuously on both sides.

Figure 6 shows both hulls, well under construction on the ways. Both boats were completely outfitted with machinery, piping, electrical wiring, steering mechanism, carpentry-work, etc., before launching.

Fig. 6—Both of the tow-boats at different stages of construction.

Fig. 4—Framing and bulkheads fitted to deck plates of forward section.

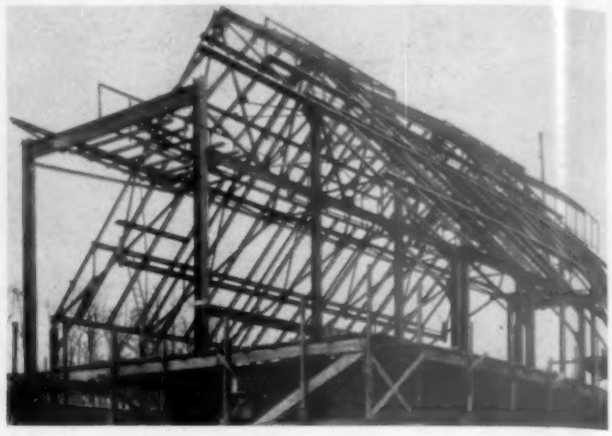


Fig. 1—Welded steel frame for power house at Spring Grove hospital, Catonsville, Md.

Despite engineering inertia, the trend is toward

Welded Steel Buildings

★ Part 1—Economic savings are possible when welded designs are employed—Further competition in structural welding is a possibility which the "regular" steel fabricator must face

By VAN RENSSELAER P. SAXE
Consulting Civil Engineer, Baltimore, Md.

NOT LONG AGO I read an account in an architectural paper of the lack of interest of architects towards welding as a means of structural assembly. The author explained how engineers had taken so ably to welding and in his opinion were running away with it. This is true to only a small degree for it is possible to name on the fingers of both hands the outstanding consulting engineers who actually design welded structural frames. On the other side of the picture, engineers working for some of the fabricators, who have been trying to develop more economical methods of steel construction, have made definite studies and efforts in this direction and because of their experience have helped more in developing the art of welding than the consulting engineer, who most definitely has been a laggard in taking advantage of this process.

Architects and consulting engineers generally are conservative and because this is a generally accepted fact, engineers have been too prone to rest on their knowledge of the old and accepted methods of structural assembly, rather than put themselves to a bit of school work to study and learn about this new tool in the structural field. A little study will show that welding is an old working hand in other lines. Most architects depend on the advice of their consulting engineer for their structural information and can hardly be blamed if their clients suffer, because their engineering advisors are not up to date and know little or noth-

Fig. 2—Welded plate girder and trusses for auditorium at Spring Grove State Hospital.

Fig. 3—Typical factory type of welded truss building.

ing about the savings which can be effected by the use of welding.

This condition seems due for a rapid change, for a new crop of younger engineers, with welding training as a part of their engineering courses are coming to the front. Unless the older men take themselves in hand, they will some day be wondering what it is all about, because the young men are going to get the business. Welding has come to stay and will have a definite influence on the economics of construction. I have heard consulting engineers defend themselves by stating they cannot get the steel fabricators to estimate welded layouts. A few years ago this was undoubtedly true for few fabricators had any knowledge, equipment, or men to do welded work, but this is certainly not true today.

We have fabricating men who often tell us that designing engineers do not even permit them to weld minor members in a structure, because Mr. Engineer knows nothing about it or does not think it is safe. I doubt if there is now a steel fabricating company of any size, employing qualified welders, who will not welcome the chance to figure and build a properly designed welded job. The matter of design is an important item to the fabricator which will be discussed later on.

The present sensible attitude of many fabricators has probably been brought about by an experience similar to the one here noted. Our first large all-welded job, constructed 10 yrs. ago, was designed as a welded frame with a riveted alternate. This was done in order that the fabricating companies could have full advantage of complete welding details required for the job, thus giving them a fair opportunity to estimate costs. Eight fabricators figured the job, but all refused to figure on the welded layout, although six of them at that time had welding equipment.

However, a company which was regularly engaged in boiler and tank welding, became interested in the possibilities of the structural field and prepared an estimate. After investigation we found that they were perfectly qualified to do the work. The net result on this building of 300 tons of steel, welded by union labor, was a saving of slightly more than $8.00 per ton over the estimated riveted cost. Since this occurrence, in this section of the country, no one has any trouble getting figures on welded designs from fabricators.

Local Welding Competition

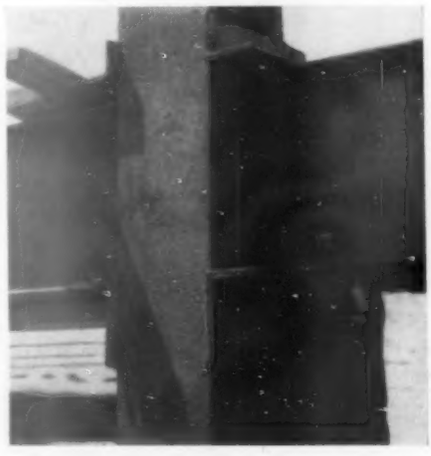
Only last summer, while traveling in Northern New Jersey, I saw a complicated overhead series of trusses for a belt-way job being assembled by welders who were employed by a local garage. The owner of this plant told me that he could get reasonable figures from the steel fabricators on a riveted job only. He knew very little about welding, but he had several large machines in the plant which were built by welding and decided to hire his own welders. He purchased the steel cut to proper lengths from detail drawings made by his engineer. The drawings gave the amount of weld required for connections. The welders assembled the steel, his workmen erected it and on completion of this job, which was close to 100 tons, he found he had saved nearly $18.00 per ton, as compared to the estimated cost of the riveted job which was to have been erected by non-union labor.

I can recite more instances of this kind which should make two classes of concerns do some thinking when it comes to looking for new business outlets. One is the fabricator who still thinks rivets are good enough and refuses to figure anything else. The other is the firm equipped to do welded tank, and miscellaneous steel work, which can expand to do structural welding and furnish keen competition for the regular steel fabricator. It is always a moot question whether the regular steel fabricator has a heavier investment cost in shop equipment than the welding fabricator. In my opinion, the fabricator with punches, shears and riveting equipment has a heavier investment burden than the fabricator who uses only a cutting torch and a welding machine.

This should give the fabricator something to think about when he continues to resist the application of welding, for the welding contractor with a good credit rating can buy mill steel just as cheaply as many fabricators. As an illustration, I have in mind a fabricator in our district who a few years ago did nothing but welded tank and similar work, and who today has a thriving structural business, because he took advantage of his knowledge of welding and applied it to structural work.

One of the common objections of the steel fabricator is the supposed adverse attitude of the union erectors towards welding, claiming that they are obstructionists who are trying to save jobs for the riveting gang and will not cooperate. I say, "Don't you believe it." Over 30 of our welded building jobs have been union erected and not once have I seen a union man who did not do his fair share to produce an economically erected job. There are plenty of union welders, former bridge men who are conscientious workmen. While it is true that one good welder can cover almost as much work as a riveting gang of four men, still this very economy will produce more building work resulting in more opportunities for employment.

Today, as a result of the depression causing the dropping out of many former union workers, the men now employed are willing to cooperate on any welded job. Probably the fact that union rules require a stationary engineer on the welding machine is one of the chief causes of irritation, but no one complains of the similar requirement of the compressor furnishing air to the riveting gang. As a matter of



A beam-to-column connection. Flanges of beams are welded to angles (top and bottom) which, in turn, are welded to column.

fact an intelligent man on the welding machine is a help to the welder, especially when he is working a distance from the machine. We should think of it from the standpoint of the economy of two men's time against the time of five men.

There still seems to be some doubt in the minds of engineers that "welds are good." In my opinion, there is just as much assurance that a weld is good as there is that a riveted joint is good. Just recently we had occasion to inspect rivets in 20 riveted trusses. Inspection with the usual light rivet testing hammer indicated that all rivets were tight, but a rule of our office is to test with a heavy hammer to see that shafts of rivets have been properly heated to fill the holes. On the group of trusses tested, we found that about half of the rivets had been heated on the end, just sufficiently to drive up a good head, so that when the head was cut off the remainder of the rivet shaft flew out of the hole. This happens often and is not as easily detected as a poor weld.

A poor weld can be detected by means of the x-ray, but the x-ray is only employed on major welds where there is a possible danger to life and property. Here is the way I look upon welding—a series of small increments of weld metal, forming a continuous bead. It is only fair to look upon a welded connection, in the same way as we do upon a riveted joint, where there may be one bad rivet in a connection having four or more rivets. The safety factor used in welded joints is higher than that used in riveted joints. Assuming that in six lineal inches of weld there may a half inch of porous or poorly penetrated area, it does not mean that the weld will fail any more readily than a comparable riveted connection. It is possible to replace a defective section in a line of weld. When such a defect is detected, there is no reason for leaving it in place.

I have attempted to cover some of the more common objections offered to welding, in order that those having an interest in welding may feel that there are good answers to any objections against its use, if they feel enough interest in the subject to undertake to work out welded job problems. Welding is on its way. When it is generally proved to be basically safe and economical it will replace more

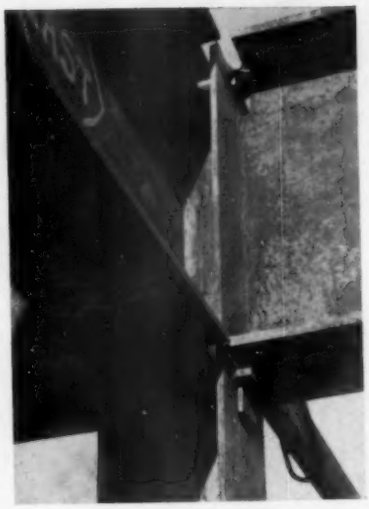


Fig. 5—Welded "erection seats" are used in making this beam connection to a column. Photo taken before final welding.

expensive methods. This naturally leads us to reasons why welding will be used more widely in the future:

Advantages of Welding

(1) It is an easy process of steel assembly requiring small capital outlay in machinery to produce a completed structure from plain mill shapes.

(2) It produces a more economical structure, both in tonnage of steel required and in man-hours, to fabricate and erect.

(3) It allows designs that produce economies which could not be undertaken by any other method of structural assembly. It is a silent fabrication and erection process which is beneficial in the fabricating shop and of great benefit to neighborhoods in which welded structures are erected.

(4) It does produce simpler connections than are required in riveted work and in many cases it is possible to produce structural designs which can be left exposed to view so that the steel blends in with the general architecture.

An ordinary beam, girder and column job can be designed to show savings up to 8 per cent as compared to riveted work. We have a 700-ton job of this nature in which welding shows, a net saving of $5.00 a ton. This saving is made by lower labor costs and by reduction in weight of steel required for detail connections and column splices. Under some conditions by developing a rigid frame design even greater percentage tonnage savings can be made.

In the modern long-span factory type of work where trusses are used, the economy of a welded design is so great that it is often astonishing. I have in mind one job requiring 2000 tons of riveted work, which when designed as a welded job required only 1600 tons. We have several jobs of this nature running from 1 to 200 tons in which savings of 18% to 22% have been made.

When it can be proved that such savings can be made, engineers will not hesitate to qualify themselves to use such a process. They can pass these savings on to owners who are reluctant to build because they feel that prices are high.

Some of the engineering design divisions of large nation-wide construction companies have not hesitated to use welding to help them get business, because building owners are discovering that welded jobs are saving money. And money is always an important item, so engineers generally should think more seriously on this subject of welded fabrication.

In the matter of details required for welded design, the first thing to do is to forget that rivets ever existed. One of the chief reasons for the feeling that welding costs more than riveting is the fact that too many welded designs have followed riveted procedure.

In order to develop economy in welded design it is essential to keep in mind that welding is basically more economical than riveting, and that punching holes in heavy sections for erection purposes, defeats the economy. If a design is developed which requires that steel be handled for hole punching in the same way that is required for the early stages of fabrication for a riveted job, then there is no economy in welded beam work. In other words to develop an economical welded building, it is necessary to design the heavy pieces such as beams, girders, trusses and columns so that they will not have to be handled through a punching machine for field bolting holes. Any heavy beam, girder or column which goes to the punch or drill for a few holes, might just as well be punched for the few additional holes required for a completely riveted job, so far as cost on this piece is concerned.

This must be definitely kept in mind and the problem is to develop field connections for field bolting which will require shop punching of small parts only. These may be shop welded to the beams and columns thus forming the

Fig. 6—Welded column splice where same sizes of columns are joined.

basis for bolted field assembly necessary to erect the steel, hold it plumb and in line by means of cable guys until the steel frame is ready for the field welding.

In order to keep sway out of a structural frame during erection, it is advisable to use at least two bolts on the top and bottom flanges of beams and girders attached to columns. Otherwise the point of connection simply acts as a pivot about which the frame rotates. As the connection of beams to girders has little to do with the erection stiffness of the structure, two bolts in the flanges of the beams, will be sufficient to secure the beams safely until the field weld is applied. In multiple-story welded structures the engineer should design his erection connections to give the erector the same feeling of security he has when he erects a riveted structure.

Need Standard Details

It is in the matter of standard shop details that the engineer who wishes to design a welded job, finds himself seriously handicapped. For practical purposes such a means of assistance in designing welded connections does not exist. Standard handbook information pertains to riveted connections only. Why the American Welding Society, or manufacturers interested in selling welding equipment, have not taken an interest in getting out the relatively simple information required to make up a set of standard welded connections corresponding to riveted connections is hard to understand.

Our office found this lack of any published set of standard details was so much of a handicap that we designed a set for office and job use which are welded equivalents of standard riveted connections for structural steel beams. We had so many requests for this information that we had the tables printed. Judging from these requests, we believe there is an open field for someone who will publish such information in small booklet form.

This represented a considerable step forward, for in our earlier welded work, it cost us more money to produce the welded design than the riveted design. Now we can, due to standardizing our own details, make an engineering design and shop detail drawings for a welded job at the same cost as for a riveted job.

Erection Seats

A perfectly secure erection connection which requires no bolts and minimizes welding is available through the use of erection seats* as shown in Fig. 5. This type of connection has proven to be satisfactory in all types of structures. Column splices in the average welded structure, can be made as shown in Figs. 6 and 7. For heavier splices and in splices subject to bending, the usual splice plates may be used as illustrated in Fig. 8. The field bolts used in all connections may be removed after the field welding is completed.

Welded trusses are more economical than riveted trusses, especially for the spans and loadings that usually occur in building construction. Structural tees may be used for the chords, permitting the direct welding of web members, and eliminating gusset plates. Wood templates for hole punching are not required but simple assembly jigs are needed. Further, in welded trusses, net sections are gross sections, thereby effecting savings in material. The greater lateral rigidity of welded trusses is especially evident when handling them during erection.

*These patented erection seats are manufactured by J. H. Williams & Co.; New York City.

Fig. 7—Welded column splice where different sizes of columns are joined.

Fig. 8—A plate-reinforced column splice in a wind-braced building.

Economy in the design of plate girders can similarly be obtained by the use of welding instead of riveting. Wooden templates are not required. The net section, as in trusses, are the gross sections. Some designers reduce the flange plate sizes from the center toward the ends and splice the plates with butt welds, but I believe it is better practice to have at least one full length plate in each flange. Proper application of weld metal and proper handling during assembly will keep distortion down to reasonable limits in trusses and girders.

Much has been written about the great advantage of figuring continuous moments in welded structures. In some cases this is true. Structures tall enough to warrant consideration of wind loads may well be designed as rigid frames and welding simplifies the connections greatly. Labor rates also play an important part. In this locality, union labor rates prevail, and our experience has shown that the savings in tonnage are usually offset by the increased amount of field welding and its attendant increased labor cost.

(To be concluded next month—Editor.)

Grinding frequently saves a machining operation and finishes welded seams so as to present a smooth neat appearance.

Factors which govern selection of

Weld Grinding Equipment

★ Part 1—Discussion of wheel types and speeds for stepping up production—Suggested techniques to employ in polishing welded surfaces—Types of flexible shaft equipment

GRINDING WHEELS are widely used in the preparation and finishing of joints for welding and also in preparing surfaces to be hard-faced. There are a number of different types of wheels available for weld grinding service. Some of these are bonded with a vitrified material, while others are bonded with resinoid or rubber. A variety of power-driven equipment is commonly employed for this service. Where the work is heavy, grinding is generally done with portable equipment.

Grinding frequently saves a machining operation. Often the welding must be finished by grinding in order to make it presentable or serviceable. If the welded parts are to be enameled or plated all welding beads should be made smooth by grinding. With modern welding technique and modern grinding and polishing methods, the finished article can be made to appear as one solid piece whether it is only a thin sheet or several inches of solid steel.

By C. A. Carlson*

★ Welded fabrication frequently requires a variety of grinding methods and grinding wheels. The purpose of grinding is to remove the excess part of the weld and produce an even, smooth surface. An outline of the grinding wheels and methods most commonly used at the present time follows.

The degree of finish desired will in large measure guide the selection of the proper grinding wheel. If the welded part is to be painted or enameled, the finish should not be too smooth. Often the weld is ground and afterwards the whole piece is shot blasted to produce a clean, rough surface for painting or enameling. If the welded part is to be polished after grinding, care must be taken to obtain a good smooth finish in the grinding operation.

Much welded work is heavy or bulky and a large part of the grinding is done with portable machines. However, if the size and weight so permit, grinding can be done faster on floor stands or swing frame machines. Portable grinders are either electric, pneumatic or flexible-shaft driven. The machines best suited for the work are those giving most power per unit

*Norton Co. Sales Engineering Dept., Worcester, Mass.

Flaring cup wheels (16 or 20 grit, resinoid bond) are commonly used.

of weight with the lowest maintenance costs.

Horizontal portable grinders with straight wheels, cone wheels or special shaped wheels are most common for grinding welds. Vertical grinders used with flaring or straight up wheels are preferred on flat surfaces and sanding operations. Practically all portable grinding machines and most floor stands and swing frame machines are designed to run at high speed or at a maximum speed of 9,500 surface ft. per min. At this speed it is necessary to use organic bonded wheels such as resinoid, rubber or shellac. As the rate of production is nearly in direct ratio to the speed, about 50 per cent higher production can be expected as compared to vitrified bonded wheels running at a maximum speed of 6,000 surface ft. per min.

For portable grinders it is a good practice to select wheels which show the highest rate of production and are hard enough to keep their shape. The cost of grinding wheels is usually only 10 to 20 cents an hour and probably less than labor, power and overhead costs, which with grinding wheels form the total cost. Anything that can be done to increase the production such as faster cutting wheels or more powerful machines will show decreased costs.

To properly grind the many different kinds of work going through a welding shop it is advisable to have several different sizes and shapes of wheels for the portable grinding machines. Flaring cup wheels (6—4½) x 2 x ⅝ in., 1 in. rim, ¾ in. back mounted on ⅝ in. threaded steel bushings or with ⅝ in. holes are commonly used. For straight cup wheels, 6 x 1½ x ⅝ in., with 2 in. rim, and ¾ in. back mounted on ⅝ in. threaded steel bushings or with ⅝ in. holes is a common size. For general work the wheel specification is usually 16 or 20 grit, resinoid. For stainless steel and other polished work it is advisable to use rubber-bonded wheels, 20 or 24 grit.

Straight wheels are used in the size most convenient for the work, 6 in. or 8 in. diameter and from ¼ in. to 2 in. thick, the most common thickness being 1 in. A coarser grit (16 to 20) size is used for thick wheels and finer grit (20 or 24) for thinner wheels. As in the case of cup wheels, it is advisable to use 20 or 24 grit, rubber wheels, in order to obtain a better surface on stainless steel and other work requiring a good finish.

Cone wheels are used for grinding out holes and for work which can be most conveniently done with this type of steel. One of the most common sizes is 2¾ in. diameter x 3½ in. with ⅝ in. threaded hole, 16 grit, resinoid.

Wheels commonly used for grinding wheels on floor stands are 16 grit, resinoid and 16 grit, rubber. On swing-frame machines somewhat coarser and slightly harder wheels are used, 14 grit, resinoid and 14 grit, rubber.

For polishing welded parts the portable sander, mounting 7 in. or 9 in. flexible fiber-backed discs, has found widespread acceptance. These fiber-backed discs are also being used in increasingly large numbers for

Straight wheels of 6 to 8 in. diameter, and ¼ to 2 in. thickness are most commonly used.

Finishing welded seams with a cone wheel and flexible shaft drive. A 16 grit, resinoid bonded wheel is a common type for this work.

smoothing weld seams in place of the much slower hand-filing method.

There is also a type of portable sander employed on this work that mounts rubber-faced drums ranging from 3 in. to 6 in. in diameter and having a 2 in. or 3 in. face. A continuous band of abrasive cloth is fitted around the face, or the drum may be of the "open jaw" type to permit affixing a strip of such cloth. For certain operations, particularly on curved surfaces, cone sanders are used. The conical abrasive sleeves for these units vary in size and shape but all are within the range of 9 in. in length.

Certain areas of the welded parts do not lend themselves readily to the flat fiber-backed discs. For this work, small polishing wheels driven by high speed portable grinders have been found effective.

In polishing there are two main factors which decidedly influence the retention of the luster on any finished piece of steel. These two factors are (a) freedom of the finished surface from minute foreign particles, particularly finely divided iron, and (b) the complete removal of all spots, scratches, pit holes or even tiny imperfections. The possibility of impurities being left on the surface may be minimized by the use of manufactured abrasive for all polishing operations. Proper selection and sequence of grain sizes; the crossing of scratches in each succeeding operation and the addition of operations where crossing scratches is impossible, will minimize the probability of scratches being left on the finished surface.

Stainless steel with its higher physical properties requires more care to

Flexible shaft equipment is highly portable and enables the operator to reach hard - to - get - at places.

precent excessive heating. Wheel speeds must be controlled, pressure must be controlled, and care must be employed in the selection of type and amount of lubricants, buffs and grain sizes. Wheel speed in polishing should range from 6,500 to 7,500 s.f.p.m. In buffing the speed should be between 10,000 to 12,000 s.f.p.m. For every operation sewed buffs are usually best, and it is important that they be in balance.

Tallow or other lubricant should be used to prevent overheating and discoloration on all operations except the first roughing and the final coloring. In roughing down operations care should be taken not to force the wheel as this often causes discoloration which is difficult to remove in later operations.

For roughing, as fine a grain size as possible should be used in order to prevent deep scratches which later may require extra operations to remove. Usually No. 60 or No. 80 is the proper grain size for roughing. For the second operation No. 90 to No. 150 grain size may be used, and for final finish from No. 180 to No. 320, depending on the type of finish required. Having selected the proper grain size and sequence of operations, the crossing of scratches will materially aid in attaining the desired results. When succeeding scratches follow in the same direction, there is a tendency for the abrasive to cut deeper.

Buffing is the final step in producing a mirror finish on stainless steel. The quality of buff should be a high count sheeting 88/88 or 84/92. The work required to get a good finish is still considerable, but the practice of practically eliminating the scratches before starting to buff and the use of a good buffing compound will do much to cut down the time. Green chrome rouge can be used, but several fine buffing compounds are now available from suppliers of polishing materials. It is good practice, however, to determine that they are substantially free from iron or other corrosive material which might be deposited on the surface and later tarnish or discolor.

Cost of grinding wheels is usually about 10 to 20 cents per hr., and is less than labor, power and shop overhead. Faster cutting wheels reduce production costs.

Flexible Shaft Equipment

Portable flexible shaft machinery for grinding and polishing reduces production and repair costs for two reasons: (1) The equipment is highly portable; (2) The flexibility of the shafting allows various types of tools to be used in the hard-to-get-at places. Flexible shaft machines may be divided into two general types—direct-drive and multi-speed countershaft drive equipment.

The direct-drive type employs a flexible shaft which is connected directly to the armature shaft of the motor. Where only one speed is required, this is an ideal installation for continuous production service, assuming that the correct speed is used.

The multi-speed countershaft drive type of equipment uses an anti-friction bearing countershaft mounted on top of the motor. Power is transmitted through pulleys connected directly with the armature by means of a leather or fabric belt. This type of machine is recommended where a variety of speeds is required. It is an all-purpose machine which can be used with different sizes of grinding wheels, wire brushes, sanding drums and buffing wheels.

With this type of equipment portability is most commonly obtained by mounting the motor on a 360 deg. swivel secured to a small metal base fitted with casters. In some shops the ceiling suspended type is employed to gain more floor space. In this type of unit the motor is suspended by means of a hanger arm accurately balanced. The unit may be in a fixed position or mounted on a trolley so that the operator can cover a large working area.

(To be continued next month.)

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THE STOODY CO., Whittier, Calif., manufacturers of hard-facing materials, are building a welded structural steel addition to their plant.

» «

THE KELLY PIPE & SUPPLY CO., Los Angeles, Calif., will soon construct a 35-mile 4-in. welded oil pipeline for the Caminol Co. This line will extend from East Coalinga to the oil company's refinery at Hanford.

Brief Sketches of Welding Jobs

Fig. 1—The Compton welded steel homes possess a decidedly streamlined appearance.

California Builds All-Welded Houses

By CHARLES F. BERRY

★ A house without a screw, a bolt or a stick of wood; a house with all steel beams, joists and studs—it sounds like a welder's nightmare, but it's attractive, economical and entirely practical.

The Compton steel homes are being constructed in Modesto, Fresno and Treasure Island in San Francisco. Designed by B. J. Compton, this new house is unique in several respects, yet beautiful on the exterior, livable and so durable that it is practically indestructible by time, weather, termites, fire or earthquake.

Not a single board or timber is used in the entire structure, fireproof material being employed throughout. All structural joints are welded. Floors and roof are of cement with pumice aggregate. Double walls are of stucco and plaster mixed with pumice. Welded steel between-the-wall doors are used for economy of space and fire protection. Although streamlined inside and out, with elliptical rooms and every corner in the entire structure rounded, the house is by no means freakish but modern and comfortable.

In spite of the fact that the labor cost is low in proportion to materials, no other home has yet been designed making such extensive use of welding. Into a modest little five-room cottage goes some 100 tons of steel and 100 pounds of welding rod. A total of 2,040 welds, averaging 2 in. in length are required. With the exception of cement workers, welding constitutes the major labor cost. Only for the forms for the suspended floor are carpenters employed. For the curved dwarfed sidewalls, forms of the clamp-together-steel type are used.

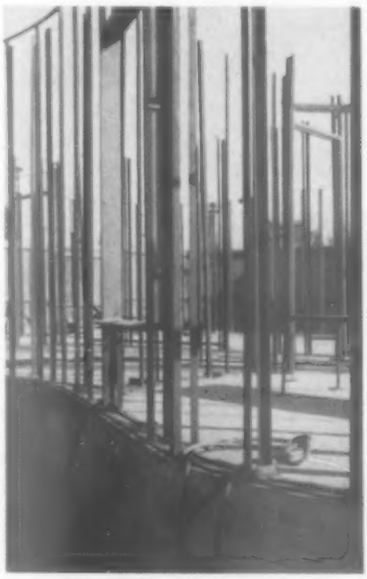


Fig. 2—Curved steel stud plates are secured to the foundation. Angle iron studs, spaced 16 in., are arc welded directly to the steel stud plates. All window openings are multiples of 16 in.

Fig. 3 — Welding the lightweight structural frame of the Compton designed home.

Fig. 4—Welding a door frame in the steel house.

Double sidewalls with a 4-in. space are employed. Curved steel stud plates are nailed to the pumice-cement foundation. A total of 300 studs of 1¼ in. x 1¼ in. x 1¼ in. angle iron, spaced 16 in. apart, are arc welded directly to the flat bar. All window openings are a multiple of 16 in. and during construction can be changed at will with the loss of only a few minutes of the welder's time. Steel window frames are welded in place and studs are tied together by pieces of one-inch flat. Throughout the structure, a total of 250 to 300 welded tie bars are used. The welded steel studs give not only permanent durable construction but light flexible framing. Elimination of plaster cracks is accomplished by using studs of sufficient flexibility and strength.

The roof structure is of steel bowstring, the cord of angle iron and the arc of T rail. One-inch angle iron is welded to the cord of the arc for the secondary member. Twenty trusses for the five-room house vary in span from 18 ft. 6 in. to 35 ft. 3 in. The roof is formed by gunited pumiceous cement over metal lath, the chord of the truss serving as the ceiling joist. The truss is designed to carry a load of 80 lbs. per sq. ft. without any partition support. The streamlining of the building is accomplished by the different height of the trusses, higher in front and tapering off in the rear. For exterior trim effect, copper shingles may be nailed directly to the cement roof.

Even in the interior finishing, wood is completely eliminated. Kitchen cupboards

and bathroom medicine cabinets are all welded steel. Closet shelves are of steel welded directly to the wall studs. A feature of economy in construction is found in the fact that all steel is of standard sizes and may be purchased anywhere. Welding starts as soon as the floor is set and continues without interruption until frame-work is complete.

Cost of the standard five-room house is approximately $1,000 per room, of which nearly 75% is for materials. Considering the permanent character of the construction, the smart modern design and the many features, including complete cold, heat and sound insulation, absolute fire protection and an air-conditioning system, the price is low. It is stated that all-welded joints reduced labor costs by at least 40%.

» «

Bridge Rebuilding Job Handled By Arc Welding

★ One of the first bridge welding jobs in Texas was completed recently near Dallas, Tex. This was the Holmes St. bridge spanning the Trinity river, south of Dallas. This was an old bridge which was widened and rebuilt to accommodate the increased traffic on this highway. The contract was let to the Texas Bitulithic Co. at a cost of $239,000 for widening and putting a new floor on the old bridge. Contract called for welding of floor beams, buck braces, level braces, armored expansion joints, pipe hand rails and stringer beams.

The state highway enginers required two inspectors on the job at all times. All welds were thoroughly tested and position welds were made up-hill and with no rod larger than 5/32 in. size. Floor beams were welded with no rod larger than 3/16 in. size. All welders who worked on the job were required to pass a special test under direction of State inspectors. The machines used on the job were, also, approved by State inspectors and were all of the 40-volt type.

This job is now completed and has proved satisfactory, creating a lot of interest in the welding of other large bridges in this state. The work was much easier on the job as the welding eliminated the handling of heavy air compressors and riveting equipment. This bridge is 2,700 ft. long with a clearance of approximately 70 ft. from water level.

M. B. Carr, superintendent for the job, has had years of experience in building bridges of this type. In his opinion the net saving in weight of steel is an item well worth considering. He also explained that investment of the contractor is considerably less in a welded bridge than in a riveted structure. Hollup Type "B" electrodes were selected for this job.

» «

Welded Land Leveling Equipment

By JOS. C. COYLE

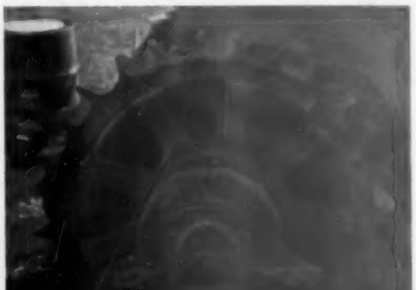
★ Sand hills, several feet high and half an acre or more in extent, are frequently involved in leveling new land for irrigation. John L. Thomas, a Yuma Valley contractor, specializes in this kind of work, using powerful diesel tractors.

Mesquite and other desert growth are uprooted with bulldozers in clearing the land. Arroyos and other low ground are filled by all-welded 14 cu. yd. carryalls. Finishing is done with a light but strong all-welded leveling scraper, pulled also by tractors. Ten years or more experimenting with leveling devices led to the development of this machine. With it, from four to five cubic yards of soil can be evenly spread at a distance of 500 ft. from the loading point and the return trip made in about 5 min. The frame of this leveler is made up mostly of steel tubing, cut to shape with the oxy-acetylene torch and arc welded at all joints. A double-edged blade of plow steel is used on the scraper. When both edges have been used until dull, they are sharpened by trimming to correct bevel with a torch, in a specially constructed cutting machine. The scraper is operated with a hydraulic ram, and moves on two 16-in. by 30-in. hollow wheels, all welded and with dust proof lubricated bearings in the hubs.

Torch and electrode are also used extensively in maintenance of this equipment. Sheave axles on the Caterpillar tractors are rebuilt when they become worn, using 3/16 in. and 5/32 in. rod. Track rollers have the wearing surface near each end rebuilt with 3/16 in. high carbon rod. For this job two 18-in. sections of 6-in. pipe were plugged at the ends and sprocket wheels from a bicycle welded on one end. A section of bicycle chain connects the two rollers, which are mounted in a light frame of welded tubing, about 18 in. high. The track rollers are laid on this jig and rotated as the welding proceeds, by means of a light flywheel welded outside the sprocket on one roller. An even surface is secured by this method, and grinding is seldom necessary. The bronze bushings in each end of the track rollers also become worn from time to time. They are built up with a bronze rod, then turned down to fit.

The bushings are pressed back in the rollers with an ordinary hydraulic jack, placed in a specially built vertical press frame, made entirely by welding scrap material. The base is a 3 ft. section of 16-in. channel, with the bottom ends of the two 48-in. sections of I beams, which form the side members, welded to it. These are braced at the top by welding a section of ½ in. by 3 in. bar across one side, at the top end. The bottom ends of the arch

Welded hydraulic press was built for installing bushing in track roller of tractor.



Rebuilt wheel of tractor. A new rim was welded on an old hub and spider, using 3/16 in. stainless steel electrodes. Each spoke weld was peened.

This highway bridge was widened and rebuilt with the aid of arc welding. Contractor used less heavy equipment on the job, than if riveting had been used.

member are welded to them. The arch is a 40-in. section of 6-in. channel, with two V-shaped cuts in each flange at the middle, and about 6 in. apart. The channel was then bent to close these cuts and then welded. A piece of 3 by 3 in. square steel bar is welded across the flanges at the middle of the arch, for the jack to rest against.

The jack is inserted on an 8 by 10 in. section of ½-in. plate, suspended from the arch by two coiled springs, with the top end welded fast. To each edge of the plate, a 6 in. section of pipe is welded, extending upward. This acts as a guide, the pipes moving outside of smaller pipes, 17 in. long, which are welded to the arch and extend down.

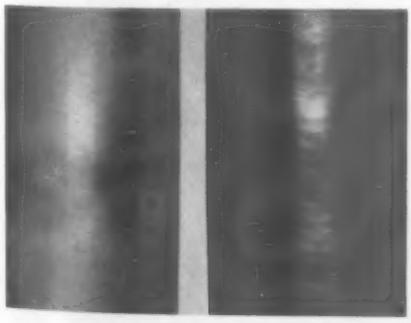
In overhauling one of the tractors recently, the rim of one rear wheel was found to be badly worn. There was no time to wait for a replacement, so a rim that was almost new was cut from a junked wheel in which the hub had broken. The spokes were flame cut from the edges leaving V shaped cuts in the inside of the rim. The worn rim was removed in the same way, leaving the spoke ends pointed to fit the vees in the new rim. The latter was welded on with 3/16 in. stainless steel rod. From four to five spokes were welded alternately, to avoid overheating, and the welds were peened after each rod.

A transverse crack was found in the track frame just ahead of the left rear wheel, extending from bottom to top and about two thirds through the frame from the inside. The crack was widened with the cutting torch to about ¼ in., and then welded up with 3/16 in. stainless steel rod. This weld was also peened after each rod, a bar with flattened end being used.

» «

Tiny Metal Globules Improve X-Ray Photographs

★ Metal shot, some so fine they float on water, play an important part in making of sharply defined x-ray photographs of irregular metal objects in the Schenectady Works Laboratory of General Electric Co. Should an x-ray photograph of a monkey wrench be wanted, for example, the technicians would pour tiny shot over and about it—spherical particles of copper or steel so small that 10,000,000 of them nestle together in a cubic inch. The photograph then obtained has all the edges of the parts of the wrench sharply outlined. Had a similar photograph been made with the wrench simply resting on the x-ray negative holder in the air, the resulting picture would have very fuzzy with blurred edges outlining the tool.



More sharply defined radiographs are obtained by using a fine copper or steel powder over the welded joint. At left, metal powder was used; at right, no powder was used and the surface ripples on the weld blur the picture.

The explanation, according to C. D. Moriarty of G-E Works Laboratory, is that there is such an emphatic difference in absorption of x-rays by air and by metals that the part of the x-ray negative, not in back of the metal, is necessarily over-exposed, with the result that the exposure "spills over" and blurs the edges of the object. Again, when the object being examined has some sections emphatically thinner than other parts, there is a similar fuzziness of edges.

One way of overcoming this difficulty in the past was to use a film of low contrast value, with special filtering screens, and requiring relatively long exposures. Even so, the x-ray pictures, or radiographs, would lose considerable detail and contrast. Another way was to immerse the article under examination in a solution of lead acetate or similar compound which is much more opaque to x-rays than is air. Such liquids improved the sharpness and contrast of the radiographs, but they still left room for improvement.

Now, utilizing metal shot, an almost unlimited range of absorption coefficients is obtainable, depending on the metal used. Uniform packing of the fine spherical particles assures homogeneity. Technicians can use the short-exposure films with intensifying screens and obtain greater contrast and detail in the radiograph.

The copper shot used in "blocking" an irregular steel object provide a background that approaches the opacity of the object, but still is sufficiently less opaque so that the radiograph of the object stands out in contrast. The copper shot used must be extremely fine so they will "flow" freely to fill all crevices, and pack uniformly—as only spheres will—to give a homogeneous background. The bright copper shot are produced by a special process developed in the G-E laboratory. For some investigations, calling for "blocking" with materials of other densities, similar shot of steel or alloys are employed.

» «

Threaded Couplings on Natural Gas Pipeline Replaced by Welded Joints

By CHARLES GEIGER

★ Five miles of standard threaded black steel pipe for an underground natural gas pipeline, on Treasure Island, Golden Gate International Exposition, failed a few months before opening of the Exposition. It was impossible to maintain 10 lbs. of gas pressure in the underground distributing system. This necessitated removal of three miles of the underground system, replacing it with new pipe electrically welded. All the threaded joints of the remaining two miles of line were reinforced by welding, without removing the pipe from the trenches.

Shortly after installing 25,700 ft. of standard threaded black steel pipe and cast-iron fittings in the sandy soil of Treasure Island, the pipeline system was connected up at the southeast corner of the Island, with the submarine pipeline installed across Oakland Bay to carry natural gas to the Exposition Island. Just before opening of the Exposition it was discovered that even 10 lbs of gas pressure could not be maintained in the distribution system. An investigation revealed that corrosion and electrolysis had badly damaged the threads of the black steel pipe, resulting in numerous leaks. The engineers decided that the underground pipeline was so badly damaged by corrosion and electrolysis, and also by the driving of tractors and heavy trucks over the soft sand, directly over the pipeline, that it would present a dangerous fire and explosion hazard if it were permitted to remain in service.

Replacing the threaded pipeline with an arc welded line.

A portion of the threaded pipe which had to be scrapped and replaced with new arc welded pipe.

Three miles of threaded steel pipe were removed from the trenches and replaced with new arc welded pipe. The new line is protected by asphaltum and paper covering. On the remaining line, where the screwed joints were reinforced by arc welding, the operators made position welds, working in bell holes, at each joint. Electrodes of 5/32 in. diameter were used.

Plug outlets for taps, 1¼ in. in diameter, were spaced every 60 ft. along the lines. An illustration shows some of the 3 miles of threaded pipe piled up in the Exposition yards, after being flame-cut and removed from the trenches. Water pipes on Treasure Island were also badly damaged by corrosion and electrolysis, but the damage was not as serious as on the threaded pipeline for gas distribution. This was no doubt due in part to the protective material covering the water pipeline.

New Product Developments

Smith welded casing is here shown (left foreground) emerging from one of the special production machines.

A. O. Smith Offers Full Line of Welded Casing

★ A. O. Smith Corp., Milwaukee, Wis., is now a full-line manufacturer of oil well casing, with a complete range of A. P. I. standard sizes down to 5½ in. outside diameter and in wall thicknesses to meet practically any casing need. Smith casing is now available in four grades including a new and still higher yield strength casing, called Super-Yield casing.

With a minimum yield point of 105,000 psi., Super-Yield casing is made in smaller sizes for extremely high collapse pressures. It is the first standard casing with such high physical strength, according to the company statement, and offers new economy with safety, particularly for deeper holes.

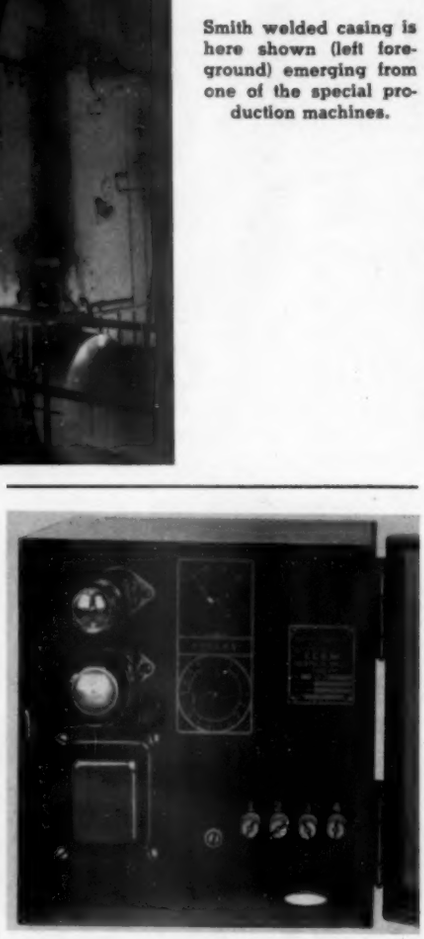
The new small sizes, like all Smith casing, are made from rolled steel plates. This permits examination of the steel before manufacture and assures uniform wall thickness. It is produced in accordance with A. P. I. standards. It is manufactured in average lengths of 50 ft., considerably shortening running time for strings by requiring fewer joints. A considerable quantity has been successfully set it is claimed.

» «

Neotron Weld Timer

★ For use with spot, butt and projection welding machines, to automatically control length of time current is allowed to flow, The Electric Controller & Mfg. Co., 2706 E. 79th St., Cleveland, Ohio, announce the Neotron weld timer.

The Neotron weld timer operates on the principle of the time required to charge a condenser to a predetermined voltage. When this voltage is reached, the condenser discharges through a neon tube to open the magnetic contactor handling the main power circuit to the welding machine. This timer gives a definite time for each weld. When used on 60-cycle frequency, this timer gives a selection of time varying from ½ to 60 cycles, by operating two small adjustable dials on front of panel. The values of time given do not include the time constant for operating the magnetic contactor.



Neotron weld timer can be adjusted for current timing from ½ to 60 cycles.

For greater length of time than 60 cycles, a timer with larger condenser is available which will give a time range from 1 to 120 cycles. A still greater time up to 300 cycles, can be secured when required.

Due to the small compact design, overall dimensions being 9 in. x 8½ in. x 7 in. deep, the Neotron timer is suited for small welders as well as for use on larger machines where a simple arrangement of definite time is adequate.

» «

Simple Method for Building Plow Sweeps

★ The Wiese Plow Welding Co., Perry, Iowa announces a new procedure for building plow sweeps in welding shops. This new method (patent applied for) has been tried out and tested over a period of two seasons, it is stated. The manufacturer offers the backs and cutting edges and a sweep jig including necessary sizes and shapes for complete sweeps. The total amount of welding required to make a sweep is about 12 in.

It is claimed that this method has proven satisfactory and profitable to welding shops, which have adopted it. Some shops have built up as many as 500 sweeps in a season. For welding shops in agricultural districts this new method will give additional profits. For further information write to Wiese Plow Welding Co. (formerly New Process Plow Welding Co.), Perry, Iowa.

» «

Bright Zinc Flake— A New Metal Coating

★ Tainton Products, Ltd., 3100 Elm Ave., Baltimore, Md., have developed a metal coating known as Bright Zinc Flake. It is claimed that with this coating it is possible to weld through the protective film. Thus, it is possible to apply the coating to surfaces before welding. The new product is also recommended for protection of welds and for touching up galvanized surfaces.

Bright Zinc Flake combines the protective qualities of zinc with a bright finish. It is claimed to be a good rust inhibitive paint. It may be used both for priming and finishing coats. The product is usually bought as a dry powder. Industrial users mix this powder with any one of a number of liquid vehicles available for use with this pigment.

» «

New Hoist Plugs Into Ordinary Lamp Socket

★ Dependability of big hoisting equipment with compact, light-weight convenience is combined in the new Comet hoist. Easily carried and installed by one man, the Comet is powered by a specially built heavy-duty, high-torque motor that runs on an ordinary light circuit. No special installation or accessories needed.

The construction of the Comet hoist is compact and rugged, yet light in weight.

Comet hoist has high-torque motor that will operate from ordinary 115-volt lighting circuit.

Precision ball bearings are provided at each rotating point. Gears are precision machined of heat-treated alloy steel. Controller, with patented "reversing" feature, operates easily with one hand and affords a sensitive control for lifting the load in distances of a fraction of an inch.

The brake is smooth, quick-acting, positive and easily adjusted. Herc-alloy "double-duty" chain is extra strong and flexible, kink-proof. Upper and lower safety stops automatically limit travel of load hook.

The Comet hoist is offered in four capacities: 250, 500, 750 and 1000 lbs., and in several speeds. Construction and operating details are illustrated in literature available by writing to Chisholm-Moore Hoist Corp., 394 Fremont Ave., Tonawanda, N. Y.

» «

Welding Flux for Aluminum and Aluminum Alloys

★ A free-flowing flux for gas welding of aluminum and aluminum alloys has been placed on the market by Park Stewart, 523 Western Ave., Aspinwall, Pa. Known as Flo-Ez-Flux, it is packed in 15, 5, 2, 1 and ¼ lb. glass containers, as shown in the illustration. These containers do not corrode, and they protect their contents at all times from moisture in the air, thus assuring a pure flux

Flo-Ez-Flux is packed in non-corroding, moisture proof glass containers.

which will not cake or harden. The 15 lb. container is equipped with a handle.

Flo-Ez-Flux will stay suspended longer than ordinary flux it is claimed and is finely ground to give a smooth weld, saving cost of dressing. It may be used to gas weld either wrought, cast or high-tensile aluminum or aluminum alloys. The manufacturer will furnish prices on request.

» «

M.S.A. Speedframe—New Type of Goggle Mounting

★ Time saved for the worker, production increased for management, are among advantages claimed for the new M.S.A. Speedframe described in a recent bulletin of Mine Safety Appliances Co. The Speedframe consists of suitable goggles mounted in a lightweight, comfortable fiber headframe, so designed that a simple nod of the head will position the goggles in front of the eyes, another nod will throw them up and out of the way. The goggles remain in either position, without further adjustment, assuring uninterrupted use of both hands.

A simple nod of the head will position goggles in front of eyes.

The assembly is fully adjustable, and holds the goggles, when lowered, properly and comfortably in place, it is stated. A copy of M.S.A. Speedframe Bulletin No. CE-7 will be mailed upon request by writing to Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa.

» «

Magnetic Contactor and Motor-Driven Timer for Resistance Welding

★ A synchronized, magnetic contactor and motor-driven timer present a new type of simplified precision welder control system which can accurately control welding periods ranging in half-cycle steps from one-half to ten cycles. It is being offered by Square D Co., 710 So. Third St., Milwaukee, Wis.

Operating without the usual mechanical clutch, the motor-driven timer is provided with a neon tube and scanning disc (*A*) which indicates at a glance the length and accuracy of each weld. A test button (*B*) on the timer panel permits selection of the stable operating points of the magnetic contactor before the machine is placed in operation. A change in timing period is accomplished by rotating knob (*C*) and the timer setting is indicated by a pointer which is provided in connection with a dial calibrated directly in cycles. Rheostat (*D*) controls the break point of the synchronized magnetic contactor used in connection with the motor-driven timing device.

Consistent operation on short timing periods is made possible by a special magnetic contactor, consisting of two separately actuated poles operated in sequence. The pole which breaks the power point, independent of the operation of the motor-driven timer contacts. The closing pole has been designed to take advantage of a little-used operating characteristic of magnetic contactors, which insures consistent operation.

Magnetic contactor and timer for precision control of welding current.

Precision control makes practical the welding of small parts, stainless steel, aluminum, brass and other non-ferrous alloys. The equipment described is easily operated, relatively inexpensive and can be applied to most types of welding machines.

» «

Low-Cost Light Weight Wire Rope Electric Hoist

★ The Speedway, a light-weight low-cost wire rope electric hoist, has been added to the present line of the Wright Mfg. Div. of American Chain & Cable Co., Inc., York, Pa. Hoisting capacities range from 250 to 750 lbs. and hoisting speeds from 15 ft. to 43 ft. per min. The Wright Speedway elec-

Lightweight electric hoist has capacity range from 250 to 750 lbs. Hoisting speeds from 15 to 43 ft. per min.

tric hoist standard construction includes fully-enclosed ball-bearing motor, anti-friction bearings, cut alloy steel spur gears, multiple-disc solenoid brake, push-button control, preformed hoisting cable and other features.

Made in three types for lug suspension, hook suspension or trolley mounting.

» «

Manhattan Duplex Welding Hose

★ Condor Duplex welding hose, a development of The Manhattan Rubber Mfg. Division, Passaic, N. J., is a twin hose designed to make welding safer and more efficient than is possible with separate oxygen and acetylene lines.

In the construction of Condor Duplex, two hose lines are held together by a permanent web joint, integrally molded, and possessing strength and flexibility. The joint prevents tangling, kinking and snagging while the hose is in use. Ends are separated 18 in.

for the torch end and 24 in. for the tank end for ease in making connections.

Condor Duplex hose may be obtained in either one or two braid, or in heavy-duty braid and spiral cord construction, depending upon working pressures used. Covers are furnished corrugated and colored red and green to distinguish oxygen from acetylene.

» «

Chemically Treated Wiping Cloth for Safety Goggles

★ IPCO Fog-gle Cloth has been introduced to meet the problem of fogging lenses in goggles, masks, shields and other safety equipment where glass is used. It is a special cloth chemically treated to retard fogging and steaming.

This IPCO Cloth will prevent lenses from collecting condensed moisture, thus destroying visibility. This feature is accomplished by a non-toxic "wetting out" agent which reduces surface tension of the glass. In using the cloth, both sides of the glass surface are wiped.

The IPCO Fog-gle Cloth is always ready for use and may be carried in a goggle case. It is claimed to be serviceable for a long period of time. The product is packed in a transparent envelope, 12 to a box, with full directions printed on the envelope. Further information can be obtained by writing to Industrial Products Co., 804 West Somerset St., Philadelphia, Pa.

» «

Marquette Tractor-Strip

★ When tractor grousers are worn down as much as 1 in. the tractor efficiency falls off rapidly. With heavy loads the tractor cannot get enough traction, consequently the work done per day is reduced. Marquette Mfg. Co., 401 Johnson St., Minneapolis, Minn., has brought out a product known as Marquette Tractor-Strip for the purpose of reclaiming worn tractor grousers. This Tractor-Strip is made of a special work-hardening alloy steel. As noted in the illustration, this strip measures 1 in. high, ½ in. thick at the bottom and tapered to 5/16 in. thick at the top. The bottom is recessed on both sides to facilitate welding the strip to the grouser.

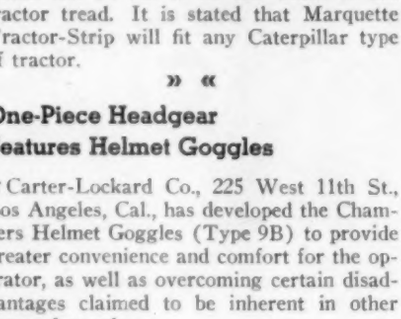
It is stated that any good grade of general purpose steel electrode may be used to do the welding. Due to the work-hardening properties of the alloy steel, the Tractor-Strip will harden with use and will wear at least as long as the original grouser. Tractor-Strip comes in 10 to 14 ft. random lengths, which can be cut to fit the width of the tractor tread. It is stated that Marquette Tractor-Strip will fit any Caterpillar type of tractor.

» «

One-Piece Headgear Features Helmet Goggles

★ Carter-Lockard Co., 225 West 11th St., Los Angeles, Cal., has developed the Chambers Helmet Goggles (Type 9B) to provide greater convenience and comfort for the operator, as well as overcoming certain disadvantages claimed to be inherent in other types of goggles.

The headgear is smoothly molded from one piece of 1/16 in. fibre which gives protection from molten metal or small falling objects. Good ventilation has been provided. An adjustable cushion sweat-band allows for differences in head sizes. The Chambers headgear weighs no more than an ordinary cap, it is claimed. It offers more comfort and greater safety than the old model .



Without pressure on face or nose, the goggles are carried on hanger arms held in place by spring washers.

Without pressure on the face or nose, the goggles are carried in a balanced position on hanger arms held in place by tension spring washers. A slight movement of the hand quickly places the goggles in any position, up or down, as the operator desires. The eye cups are molded of Textolite.

Application of Marquette tractor strip for reclaiming worn grousers. Note recesses to facilitate welding.

No lifting or raising of window is necessary to obtain clear view of work.

"CESCO" Twin-View Welder's Helmet

★ The Cesco Twin-View Helmet incorporates a new principle which enables the welder to obtain a clear, unobstructed view without exposure to flashes or injurious light rays. Unique in design and construction, it is said to have decided advantages over conventional type helmets. No lifting or raising of window is necessary.

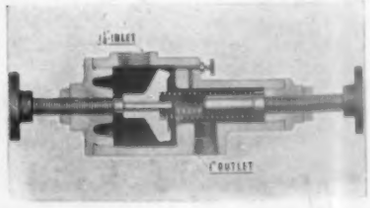
In addition to accommodating a standard welding lens, the Twin-View lens holder provides a clear, glass-covered aperture for inspection or layout of work. Injurious light penetration at this point is prevented by an extending hood, located at the lower part of the lens holder, which shields the aperture against direct arc rays. The helmet is constructed of vulcanized fibre with an adjustable headgear.

The manufacturer, Chicago Eye Shield Co., 2300 Warren Blvd., Chicago, Ill., will send descriptive literature and prices upon request.

» «

A New High-Pressure Adjustable Relief Valve

★ Victor Equipment Co., Welding Equipment Division, 844 Folsom St., San Francisco, Calif. is marketing an adjustable pressure relief valve for operating pressures up to 600 psi. Both inlet and outlet are ⅝-in. No. 18 thread with flat seats. Sturdily constructed, simple in design, and accurate, these adjustable high-pressure relief valves were originally designed to meet the requirements of oil refinery laboratories. The manufacturer claims that the reliability of these relief valves make them suitable for a multitude of high-pressure gas applications.



Adjustable pressure relief valve (up to 600 psi.) for high-pressure gas applications.

News of the Industry

Change of Address—The Welding Engineer Publishing Co. announces a change in its Chicago office from 608 So. Dearborn St. to 506 So. Wabash Ave. All correspondence relating to either The Welding Engineer or The Welding Encyclopedia (Ninth Edition) should be sent to the new address—506 So. Wabash Ave., Chicago, Ill.

I.A.A. Adopts Revised "Hose Connection Standards"—This latest revision of the I.A.A. "Hose Connection Standards" was undertaken by a committee consisting of J. J. Crowe, chairman, E. H. Krein, Lorn Campbell, Philip Kearny and R. J. Kehl. The committee's recommendations were submitted to some 60 interested company members of the association for comment. Their comments were referred back to the committee and the final draft was adopted at the recent Houston meeting.

The idea is to insure interchangability of parts made by various manufacturers, by requiring them to hold to certain dimensions, within the limits of the standardized drawings. At the same time, the manufacturers are permitted to use their own judgment and follow their usual practice as far as possible. Here are the items standardized:

(A) Size, type, and kind of thread. (B) Angle and outside diameter of internal seat. (C) Radius and distance of radius center of external seat from shank shoulder. (D) Diameter of shank shoulder. (E) Diameter of hole in nut. (F) Large diameter of hose shank. (G) Fuel gas nuts to be designated by annular groove around nuts cutting corners.

Here are items left optional:

(A) Material. Strength equal or greater than free turning high brass. (B) Diameter of drilling through external fitting and gland. (C) Form of end of shank except seating section as dimensioned. (D) Length of hose shank. (E) Type and number of serrations on hose shank. (F) A second shoulder equal to the larger diameter of the largest shank to extend through the hole in the nut for appearance, may be used or omitted for smaller diameter shanks. (G) Length and location of hexagon wrench section on nut.

» «

Parade of the Iron Horses—The old and the new are lined up side by side in this picture taken in Los Angeles, Calif. At left is a wood-burning steam locomotive used in 1865 by the Union Pacific railroad. Next to this old timer is the nose of the new 5000-hp. steam-electric locomotive, first of its kind in the world (built by General Electric for Union Pacific). Next is the G.E.-equipped diesel-electric "City of Los Angeles." The conventional steam locomotive at the extreme right is said to be the most powerful steam locomotive in the United States and now in regular use on the Union Pacific.

» «

A.W.S. Day at New York World's Fair—New York Section, A.W.S., is sponsoring a special A.W.S. Day, Monday, May 29, 1939, at the New York World's Fair. Plans for the day include a reunion at A.W.S. Headquarters on the Fair Grounds, luncheon at the Schaefer Center, tours through the exhibits aided by uniformed guides, and finally a Grand Reunion Dinner at Schaefer Center, without any speeches to mar the festive spirit. Reservations should be made promptly to Charles Kandel, chairman, 2727 Jackson Ave., Long Island City, N. Y.

» «

Eighth Annual Welding Engineering Conference, Ohio State University, Dept. of Industrial Engineering, Columbus, Ohio

Thursday, May 11th:

Exhibits and Demonstrations.

Address of Welcome, by William McPherson, acting president, The Ohio State University.

"Structural Welding—Rigid Frame Construction," by E. W. P. Smith, Lincoln Electric Co.

"Welded Tanks," by H. C. Boardman, president, American Welding Society and research engineer, Chicago Bridge & Iron Co.

"Structural Steel Welding in New York City," by A. N. Kugler, Air Reduction Sales Co.

Exhibits and Demonstrations.

Dinner Meeting — Columbus Section A. W. S.

"Unionmelt"—Talk and Motion Picture, by E. E. Radcliffe, Linde Air Products Co.

Friday, May 12th:

"Designing and Welding Large Machines," by A. E. Gibson, president, Wellman Engineering Co.

"Surface Hardening and Hard-Surfacing," by C. E. MacQuigg, Dean, College of Engineering, The Ohio State University.

"To Weld or Not to Weld," by Roger B. White, welding engineer, Lewis Welding and Engineering Co.

"Engineering Aspects of Resistance Welders," by S. M. Humphrey, chief electrical engineer, Taylor-Winfield Corp.

Exhibits and Demonstrations.

Testing of Welded Structures at the Engineering Experiment Station, directed by Professor J. R. Shank.

» «

260-Lb. Rorot Dramatizes Sensitive Electrical Controls—After two years of life as a sheaf of blueprints and scattered pieces of metal in the laboratory of the Westinghouse Electric & Mfg. Co.'s division at Mansfield, Ohio, "Elektro" is ready. His more than 900 hand-made parts have been bolted or welded into place, his 11 motors tuned up, and his electrical brain of 48 relays is now ready to dramatize for visitors at the 1939 New York World's Fair, modern control principles at work in industry. "Elektro" can walk, and talk, and count up to 10 on his fingers, and can smoke cigarettes by the dozen. And despite his youth, "Elektro" never tires or gets hungry. He stands 7 ft. in his aluminum feet and has an 82-in. chest expansion.

"ELEKTRO," the moto-man, is a dramatic portrayal of the manner in which electrical gadgets, such as photo-cells, relays, motors, and other sensitive devices may be put to use to lighten the human load in industry.

» «

Budd Develops New High-Speed Railroad Brake—A new type of railroad brake which will bring high-speed trains to a smooth, comfortable stop within 2,500 to 3,000 ft. from 100 m.p.h., about half the distances now required, has been developed by the Budd Wheel Co. With its high efficiency, the new brake is an important contribution to safe high-speed train operation. The new system represents a complete change in design from the conventional brake with its metal shoe working against the rim of the wheel.

Instead, the engineers have patterned the new brake somewhat after those used in automobiles, in that a composition shoe is

Welding has played an important role in locomotive building.

Technical Literature

We have listed below brief reviews of new technical literature prepared by experts in the employ of welding equipment manufacturers. Any literature you may desire will be sent to you free of charge. Merely check or mark the serial number of the paragraph on the order blank at the bottom of the page. No obligation.

Pipe Fittings for Welding

(103) Bonney WeldOlets and ThredOlets are described and piping applications illustrated in a 16-page bulletin issued by Bonney Forge & Tool Works. These are special fittings, available in stock sizes, designed to simplify the job of making welded pipe junctions. Dimensional charts and data on sizes carried in stock will be found in the bulletin. Methods of installing these fittings are clearly illustrated.

Acetylene Cylinders

(104) "What Goes In the Bottle" is the subject of a four-page folder issued by Independent Engineering Co. This folder describes four types of tests which are applied to Independent acetylene cylinders in order to determine their compliance with I.C.C. regulations, governing transportation of acetylene cylinders.

Stainless Steel Electrodes

(105) "McKay Certified Stainless Electrodes" is the title of a new 16-page booklet explaining certification process of weld deposit analysis and other features of McKay Certified Stainless Electrodes. Also includes practical metallurgy and welding procedures for 12 stainless analyses, with complete list of stainless type numbers and corresponding chemical analyses.

C.I.G. Catalog Sheets

(106) Compressed Industrial Gases, Inc., has catalog sheets available covering Victor oxy-acetylene welding and cutting equipment and gas welding accessories, such as goggles, rubber hose and welding flux.

Cast-Iron Electrodes

(107) The Chicago Hardware Foundry Co. has developed a new cast-iron electrode for depositing machineable weld metal on cast iron. A data sheet is available describing No. 21 electrode and recommending proper currents and 300 deg. F. preheat.

Diamond Wheels

(108) The Norton Co. has prepared a small folder covering two types of diamond wheels for grinding the cemented carbides. No. 1 is a new Metal Bonded wheel and No. 2 is the Resaloy wheel.

Jackson Eyeshields

(109) These industrial safety eyeshields are described and illustrated in a small folder issued by Jackson Electrode Holder Co.

Hobart Folder

(110) Presents actual examples and facts to prove what can be accomplished with the new 40-volt Hobart arc welder. Claims that tremendous savings and profits are possible with arc welding.

Gas-Driven Arc Welders

(111) A new Hobart bulletin printed in two colors containing specifications on gas-driven arc welders. It gives a man information he is interested in as to mechanical make-up, as well as to special features on this type of equipment.

Fume Collectors

(112) The subject of exhaust ventilation for welding operations is covered briefly in this 4-page folder just issued by Ruemelin Mfg. Co. Stresses value of using local exhaust hoods.

Torchweld Catalog

(113) New Torchweld catalog No. 39 illustrating and pricing Torchweld non-flash hand and machine welding and cutting torches. Includes aircraft welding torches, brazing torches, lead welding torches, cutting attachments and guides, oxygen and gas pressure regulators, gas saver boxes, steel carrying cases, portable trucks, welding and cutting accessories.

THE WELDING ENGINEER May, 1939

506 So. Wabash Ave., Chicago, Ill.

Please send me the literature as checked [X] on the list below:

103 ☐	106 ☐	109 ☐	112 ☐
104 ☐	107 ☐	110 ☐	113 ☐
105 ☐	108 ☐	111 ☐	

(To be sure of receiving literature ordered please indicate below your company affiliation and position.)

Name .....

Street Address .....

City ..... **State** .....

Company Affiliation .....

Position .....

used, which exerts pressure upon an air-cooled disc or drum, mounted on the axle inside the wheel to bring the train to a rapid and smooth stop. Fins attached to the discs work much like an electric fan to throw off heat generated in the braking operation. Special control devices automatically prevent the wheels from sliding when the brakes are applied too suddenly.

The new brake is said to solve many of the problems of high-speed train operation. The new brake was developed in the research laboratories of the Budd Wheel Co. under direction of C. L. EKSERGIAN, chief engineer. First complete train equipped with the new brakes is the "General Pershing" Zephyr, of the Burlington Lines.

Personals

G. COOK KIMBALL has been elected an executive vice-president of the United States Steel Corp. of Delaware, with headquarters at its Chicago executive offices, 208 So. La Salle St. Formal announcement of this new activity was made at a luncheon given by Benjamin F. Fairless, the Corporation president, at the Blackstone hotel, April 26th. Several hundred civic and business leaders attended the luncheon to meet the officers and directors of the Corporation.

Mr. Kimball is well known in Chicago, where for many years as an official of the

G. COOK KIMBALL

Illinois Steel Co. and later of the Carnegie-Illinois Steel Corp., he has maintained his executive offices. For the past four years, he has been executive vice-president of Carnegie-Illinois Steel Corp. He has been connected with U. S. Steel subsidiaries since 1901, beginning in the engineering department of American Tin Plate Co. a year after his graduation from Harvard university. From 1905 to 1931 he served as chief engineer of the American Sheet and Tin Plate Co. and in 1931 was elected vice-president and a director of the company. Mr. Kimball is a director of Carnegie-Illinois Steel Corp., president of Illinois Steel Co., president of Gary Land Co., and a director of The Illinois Manufacturers' Association.

This badly cracked Engine Block completely repaired in 10 hours

Oxy-acetylene welding with 10 lbs. of Tobin Bronze rod saves 300 lb. casting from the junk pile

When cracks appeared in the base of this crude-oil engine block, attempts to prevent their extension by clamps proved futile. In a short time they had practically encircled the cylinder—only fifteen inches of solid metal remaining between the ends of the cracks.

In this condition the engine was of course useless. A replacement meant a large investment and an important time loss waiting for the new casting. It was then that Tobin Bronze welding was suggested. And just ten hours after that suggestion was made, the engine base was ready to go back into service.

Every day, in all parts of the country, similar incidents demonstrate that expensive equipment, seemingly damaged beyond repair, can often be salvaged at nominal cost by welding with Tobin Bronze—a time-tried Anaconda product. The trade-mark "Tobin Bronze Reg. U. S. Pat. Off." is stamped in every rod. Look for it to make certain that you are getting genuine Tobin Bronze. 39130

MELTING POINTS OF ANACONDA WELDING RODS

Material	Approx. Melting Point—Degrees Cent.	Fahr.	Material	Approx. Melting Point—Degrees Cent.	Fahr.
Tobin Bronze* . .	885	1625	Phosphor Bronze E	1070	1958
Anaconda 520 . .	885	1625	Phosphur Bronze D	1000	1832
Manganese Bronze	870	1598	Phosphor Bronze C	1025	1877
Anaconda 997 (low fuming)	870	1598	Silicon Copper . .	1083	1981
Brazing Metal . .	930	1706	Deoxidized Copper	1083	1981
Economy Bronze* .	885	1625	Electrolytic Copper	1083	1981
Everdur*	1019	1866	Super Nickel . .	1225	2237
Phosphor Bronze A	1050	1922	Nickel Silver . .	1055	1931

*Trade-marks Reg. U. S. Pat. Off.

ANACONDA *Anaconda Welding Rods*

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut

In Canada: Anaconda American Brass Ltd., New Toronto, Ont. • Subsidiary of Anaconda Copper Mining Company

Construction

NATIONAL ELECTRIC WELDING CO., of Huntington Park, Calif., has completed its contract for welding the structural steel frame of a new 3-story building for Southern California Telephone Co. This is a 100% welded structure.

» «

PACIFIC GAS & ELECTRIC CO., of San Francisco, will start work in the near future on a 35-mile, 8-in. welded gas pipeline from Marysville to Lincoln, Calif. The line will furnish fuel gas to the Gladding-McBean Pottery Works, at Lincoln.

Trade News

WILLIAM W. CAMP has recently been appointed manager of brass and bronze welding rod sales for M. A. PURVIN & Co., 53 W. Jackson Blvd., Chicago, Ill., representatives of TITAN METAL MFG. CO., Bellefonte, Pa. This company manufactures Titan welding rods, shapes, forgings, and automatic screw machine parts of brass and bronze. Mr. Camp will cover the Central West.

» «

NEW ENGLAND WELDING LABORATORIES, 88 St. Stephen St., Boston, Mass., is conducting a welding school under a plan which insures adequate individual instruction. GEORGE R. SINGLETON, a retired naval officer, who has been in touch with welding developments since 1911, is in charge of the school.

Classes are held morning, afternoon and evening, but students are restricted to one class per day. Only one student is allowed to work with one outfit in any one class. Textbooks are provided but classwork is held at a minimum and instruction is largely individual. Standard length of courses is 120 hours. A large percentage of students are already employed, including salesmen, foremen and insurance inspectors. Training facilities will provide for a total enrollment of 35.

» «

METALLIZING ENGINEERING CO., INC.—This company has found it necessary to expand its plant and office facilities by consolidating general offices, plant and warehouse at a new location, 21-07 41st Ave., Long Island City, N. Y. This change in location was effective April 21st.

» «

STULZ-SICKLES CO., 134 Lafayette St., Newark, N. J., has appointed two new distributors of Manganal products: (1) Pratt-Gilbert Hardware Co., Phoenix, Ariz., and (2) W. S. Hiler & Co., 427 W. San Antonio St., El Paso, Tex.

Current Reviews

NEW METHODS OF PUBLISHING A.S.T.M. STANDARDS—Important modifications are to be made in the methods of publishing the A.S.T.M. standard specifications and tests. These changes are to become effective November, 1939. The major change is to combine the Book of Standards (issued triannually) and the Book of Tentative Standards (issued annually). These changes, which also embody numerous advantages, are necessary because of the growth of A.S.T.M. standardization work. All of the 870 A.S.T.M. standards are in use in many branches of industry and commerce. Each is available, and will continue to be, in separate pamphlet form and the standards have been issued in tri-annially published books of standards with an annual volume giving so-called tentative standards and tests.

The new method of publication will be to issue the standards and tentative standards collectively in one tri-annual publication, divided into three parts: Part I, Metals; Part II, Non-Metallic Materials—Constructional; and Part III, Non-Metallic Materials—General. Further details of the publication plan can be obtained from headquarters of American Society for Testing Materials, 260 So. Broad St., Philadelphia, Pa., including sales prices for the new Book of Standards, 1940-41 Supplements, and the Annual Proceedings.

» «

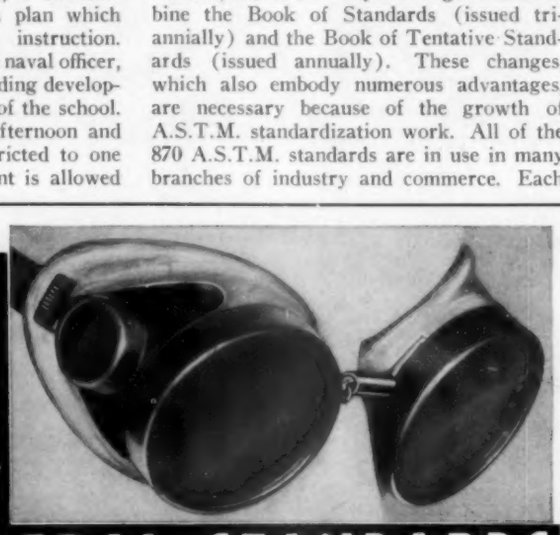
"THE KNACK OF SELLING YOURSELF"—By James T. Mangan. Price $2.50. Published by The Dartnell Corp., Ravenswood and Leland Aves., Chicago, Ill. The "merit system" which we had drummed into us in school just won't work, says the author of this thought-provoking book. "The people who get on, who make big money, are those who are smart enough to sell themselves," according to James T. Mangan. He claims, also, "Millions of people today with brains and real ability are being pushed around by others who have no brains and less ability, simply because they don't know how to sell themselves. You may be loaded with talent but unless you can sell it, it isn't worth two cents."

In his new book, Mangun sponsors the "get-there" system as being the only practical success theory to follow today. He believes we should become a nation of salesmen—selling "living merchandise." This book contains some pretty strong meat. It is written in a fascinating but dogmatic style, which may possibly antagonize some sensitive souls.

We cannot agree with all of his swashbuckling theories of success, some are likely to lead young people along the wrong road, unless they mix in a judicious measure of common-sense with the author's blustering philosophy and egotistical skullduggery. Obviously written in sensational style to rank in the "best-seller" class, if that is possible. This book should be of more benefit to men in merchandising and promotional activities than in engineering and technical fields.

No doubt many men in business have "bluffed" their way to the top, but only in those fields where no exact measurements are possible, where "art" reigns supreme and "science" is given an inferior rating. Unfortunately, advertising still remains in this category.

WILLSON WELDING Goggles MEET FEDERAL STANDARDS



TAKE NO CHANCES! Specify WILLSON WELDING GOGGLES, not only because they meet rigid Federal Specifications, but because they provide the utmost Comfort and Durability in Service.

Style RW50, illustrated above, employs 50 mm. WILLSON-WELD Filter Lenses and 50 mm. clear cover lenses. The composition eye cups are anatomically shaped to fit over the orbital cavity and are heat and moisture proof. Patented indirect ventilation ports assure ample flow of air but exclude injurious light flashes, sparks, etc.

THERE'S PROFIT IN WILLSON Protection

Let a Willson Safety Service Representative make recommendations without obligation.

DOUBLE WILLSON PRODUCTS INCORPORATED READING PA. U.S.A. Established 1870

INDUSTRIAL SAFETY EQUIPMENT ASSOCIATION

GOGGLES RESPIRATORS HELMETS

Recent Patents

FILLED FABRIC ELECTRODE COATING

2,150,925. ARCHIBALD P. JOHNSTON, Altadena, Calif., assigned to Standard Oil Co., Calif. Filed Oct. 19, 1936. Issued Mar. 21, 1939. According to this patent a metallic electrode is covered with a cellulosic fabric covering, such as an open mesh braid of

cotton or rayon. The fabric is then filled with solid fluxing materials preferably in powdered form, although a paste or slurry form can be used to obtain adhesion of the flux to the covered electrode. The flux consists of 10 to 30% aluminum oxide, 0 to 10% manganese carbonate, 20 to 50% titanium oxide, 15 to 35% sodium silicate, and 0 to 50% silica. The silicate acts as a binder for the coating components as well as adding silica to the slag formed by the heat of the welding arc. The manganese carbonate may be replaced partially or wholly by ferromanganese. In manufacturing the coated electrode, the fabric covered rod is passed through a bath of the flux and the flux is rubbed into the fabric covering. Excess flux is then removed by passing the treated rod through a die. The impregnated rod is finally dried at 200 to 250 deg. F.

» «

Welding Rotatable Work

2,151,378. George W. Elsey, La Grange, Ill., and Charles F. Wittlinger, Dayton, Ohio, assigned to General Motors Corp., Detroit, Mich. Filed Aug. 23, 1937. Issued Mar. 21, 1939. An automatic arc welding apparatus is described for welding rotatable work, such as a rotor. A work-holder locates the work in proximity to the welding electrode; motor-actuated elements being provided for effecting rotation of the work-holder at a definite rate of speed.

» «

Gas Welding Torch

2,151,443. Philip Ruch, Cleveland, Ohio, assigned to Ferro-lene Gases, Inc., Cleveland, Ohio. Filed Sept. 26, 1936. Issued Mar. 21, 1939. A multi-flame torch is shown in this patent. The torch has a central flame and an outer enveloping flame. The outer flame surrounds and serves as a de-oxidizing cloak for the central welding flame. The outer flame also operates to produce a preheating zone, whereby a high temperature is obtained in the zone of the central flame. The torch head has a single gas inlet duct, but two inner passages are provided to the two-flame nozzles. Suitable valves control rate of gas flow in the passages.

» «

Welding Circuit

2,151,786. Ralph E. Marbury, Wilkinsburg, Pa., assigned to Westinghouse Electric & Mfg. Co. Filed Nov. 24, 1937. Issued Mar. 28, 1939. A welding circuit energized from a source of power, and a high-frequency control circuit energizable from the circuit, when the circuit is open, to apply a high-frequency voltage to the welding circuit.

» «

Welding Electrode Holder

2,151,871. Ernest Riemenschneider, Lakewood, and Martin G. Fettel, Cleveland, Ohio, assigned to The Midland Steel Products Co., Cleveland, Ohio. Filed Oct. 28, 1937. Issued Mar. 28, 1939. The patentee has designed a light and well balanced electrode holder which relieves fatigue in using and operating the holder. The holder can be operated rapidly by a flick of the finger in gripping or releasing the electrode. Automatic latches are provided for maintaining the holder jaws in a gripping position.

Welding of Copper Alloys

2,151,758. John R. Gier, Jr., Penn Township, Pa., assigned to Westinghouse Electric & Mfg. Co., Pittsburgh, Pa. Filed Nov. 28, 1936. Issued Mar. 28, 1939. The welding of copper and copper alloys is simplified by a process disclosed in this patent. Heretofore, it has been found difficult (says the patentee) to secure satisfactory welds of members of high conductivity, such as copper and copper-bearing alloys, by resistance or spot welding methods. This, the patent states, has been due to the exceedingly low contact resistance of such metals. In welding such metals, as much heat is often developed at the points of contact of the electrodes with the members, as is developed between the members themselves, where it is desired.

This results in excessive heating and burning of the electrodes, which greatly shortens their life, and also pits, heat stains, and otherwise mars the surfaces of the members. At the same time, insufficient heat is produced between the members themselves, so that there is only partial fusion between the members, giving generally an altogether unsatisfactory weld. Solid, granular, and powdered materials interposed between the surfaces of the members have been tried, such as carbonaceous materials, as well as iron powder and filings, to increase the contact resistance and thus localize the heat. Some chemicals have been used even to react chemically to produce additional heat at the point of welding. Such materials as iron and carbon are stated to form porous and brittle welds at times.

The invention uses metals of the group of manganese, nickel, and cobalt. These

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TITAN BRONZE WELDING ALLOYS

metals not only increase the contact resistance between the members, thereby localizing the heat of welding, but they also serve as reducing agents to remove oxide film, and they act further to produce sound and ductile welds of high tensile strength. The inventor seems to think that the improved properties of the weld may be due to an actual fusion alloying of the metals with the copper of the members welded, since manganese, nickel, and cobalt are all soluble in copper. This results in an alloy weld zone which, instead of having a sharp line of demarcation at the junction of the members, consists of a continuous transition from one member to the other.

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WELDING APPARATUS

2,151,914-5. ROBERT K. HOPKINS, New York, N. Y., assigned to M. W. Kellogg Co., New York. Filed Sept. 16 and Nov. 5, 1936, respectively. Issued Mar. 28, 1939. Systems are described in these patents, whereby constituents of the desired deposited metal are supplied to the welding gap in separately controlled streams, so that with any set of constituents, weld metals of wide variation in analysis may easily be obtained. Preferably some of the constituents are supplied in the form of a hollow metallic electrode and the remainder are supplied in the form of powder, granules, pellets, or wire, and fed to the welding gap through the hollow electrode. Thus, for instance, when it is desired to deposit an iron-chrome alloy upon carbon steel base metal, the hollow electrode is made of mild steel and the chromium is supplied as ferro-chrome. With this set of constituents, a wide range of iron-chrome alloys may be deposited. The process is applied particularly to the electric fusion of metals, such as fusion welding, veneering, or the coating of metallic surfaces. The patents describe devices for carrying out this process.

ELECTRIC WELDING

2,152,194. LLOYD T. JONES, Berkeley, Calif., assigned to Union Carbide and Carbon Research Labs., Inc., New York. Filed April 17, 1936. Issued Mar. 28, 1939. A method of electric welding which comprises providing an unbonded granular non-metallic material of high electrical resistance and having a negative temperature coefficient of resistance in full contact with all the surfaces to be united by welding; inserting an electrode into this material; passing an electric current to melt progressively the portion of the electrode in the material and to heat and melt progressively some of the material; and applying a magnetic field with controlled magnetic flux lines to increase the lateral penetration of the welding heat in the surfaces and to decrease the vertical penetration of the heat. (Apparently relates to the Unionmelt welding process.)

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PRESSURE CONTROL ON ELECTRODES

2,152,596. CARL LORENZ, Chicago, Ill., and CLYDE F. KAUNITZ, Bay City, Mich. Filed Nov. 8, 1937. Issued Mar. 28, 1939. Air regulators are provided for regulating the air pressure supplied to the electrode cylinders of a resistance welding machine. The pressure is varied according to the positions of the electrodes in relation to the work as the carriage of the welding machine moves over the work.

She found the soap—
pretty easily, but my, how painfully.

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Trade Literature

"AMCO" GALVANIZING AND TINNING COMPOUNDS—American Solder & Flux Co., Wayne Ave. and Berkley St., Philadelphia, Pa., has just published a folder describing two new materials made by this company, Amco Galvanizing Powder and Amco Tinning Compound. These metal protective materials are employed in making repairs on hot dipped galvanized and tinned equipment.

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Obituary

J. ALBERT ROESCH, JR., president of Steel Sales Corp., Chicago, Ill., died suddenly on April 27 at Pittsburgh, Pa., where he had gone on a business trip. He organized the Steel Sales Corp. in 1915, and was also a director of the Mercantile Trust and Savings Bank, and of the Copperweld Steel Co. of Pittsburgh.

Mr. Roesch, 57 years old, was born in New York City, although the greater part of his life was spent in Chicago. He moved to River Forest (a suburb of Chicago) with his family eight years ago. He was a member of many social and civic clubs, including Riverside Country Club, Bobolink Golf Club, and Illinois Athletic Club of which he was a past president.

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DR. C. F. HIRSHFELD, well known educator and engineer, chief of research of The Detroit Edison Co., died at Grace Hospital, Detroit, Mich., April 19, 1939, after an illness of several months.